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n this issue

1 **Civil Aviation Debated**
3 **Rockets and Satellites at Cranfield**
7 **Turboprop v. Turbojet**
8 **Other People's Nationals**
9 **British Nationals at Lasham**
0 **Lasham's Royal Opening**
3 **Gyron**
9 **Leaves From a Log-Book**

Debatable Point

ON the evening of July 22 the House of Commons debated the Government's civil aviation policy, with particular reference to the Minister's acceptance of the Air Transport Advisory Council's recommendations for the future revision of Colonial-coach services (*Flight*, July 5).

At the risk of over-simplification, the main line of argument might be summed up as follows. The Opposition feel that the loyalty and enthusiasm of the Corporations' work-people is being upset by a "thin-end-of-the-wedge" decision of the Government to give private-enterprise airlines a 30 per cent share of thrift-class African traffic when it is introduced. The Government defend their policy by re-iterating that it merely allows private enterprise to keep a fair share of the class of traffic which (at its own financial risk) it pioneered five years ago. The Government feel that this is an extension, not a change, of existing policy, designed to permit the *whole* of British air transport to increase its share of expanding world traffic while recognizing the chosen-instrument status of the Corporations.

Reduced to these terms, the controversy assumes the dimensions of a storm in a teacup. Yet last week's protest meeting of B.O.A.C. workers is evidence —but not necessarily proof—that the Government's policy is not as acceptable as it might be. It is probably the trade unions' feeling that although the new policy may not immediately threaten their members' livelihood it represents a trend which must be arrested before it does so. But with equal justification, we imagine, Airwork's and Hunting-Clan's workpeople could protest—for the very opposite reason that the Corporations are to take 70 per cent of the business which their companies pioneered.

Croydon's Eleventh Hour

TWO events last week must have given Mr. Airey Neave, M.P., food for thought about the future of London's airports. As reported in our previous issue, Mr. Neave (who is Joint Parliamentary Secretary to the M.T.C.A.) began the week with a tour of the bulldozed wastes from which the modern new airport of Gatwick will emerge. On the following day he received a deputation from the Croydon Chamber of Commerce—representing users of the Croydon Airport and other business men of the borough—urgently seeking to stay the closure of the airport ordained in the Government's White Paper of 1953.

It was stated then that when Gatwick opened—and the indications are that it will do so, on time, in April next year—the "small grass aerodrome" should close; Croydon's commercial operators should move to Gatwick, and executive and private flying go elsewhere. But not, it is clear, to Gatwick, which will in any case soon be heavily engaged with the commercial overflow from London Airport (B.E.A. are already threatening to make deep inroads into the available space, leaving less than sufficient for all Croydon's operators); nor to Kenley, which is too small; nor—Croydon users hope—to Blackbushe, White Waltham, Fair Oaks, Biggin Hill, or Southend, all of which are too far out of London ever to become satisfactory business airports.

Where else south of London except Croydon (or even north, further from the short Continental sea crossings) can business and light charter flying, with attendant facilities for Customs, radio, refuelling, repairs and hangarage continue, and be allowed—even encouraged—to develop? Might not a metropolitan "small grass aerodrome" (quite suitable for aircraft of up to 25,000 lb) less than forty minutes' travelling time from the centre of London be very suitable for the development of public and executive STOL and helicopter transport?

At a time when air traffic is expanding so rapidly that doubts are already being expressed as to Gatwick's capacity to handle the growth of traffic projected for even a few years ahead (Croydon's movements alone have *more than doubled* since the White Paper was published four years ago) we simply cannot afford to lose to the creeping urban paralysis of shops and houses the priceless "real estate" commodity of a developed metropolitan airport. One thing is certain: if Croydon is closed, an irrevocable step will have been taken. It could never open again.

FROM ALL QUARTERS

The R.A.F. Run-down

OFFICIAL statements on the planned run-down of the Royal Air Force, announced last week, suggest that its scale will not be comparable with that of the Army, whose reduction is expected to be greater than that of the other two services combined. The number of R.A.F. officers and N.C.O.s likely to be declared redundant is unlikely to exceed 700 and 1,000 respectively, according to an Air Ministry announcement. Redundancies among officers in the principal branches will occur mostly in the rank of squadron leader and above, and a scheme of monetary compensation has been announced.

Further details appear on our "Service Aviation" page (173) in this issue.

Asked in Parliament last week if it was intended to increase the strength of the W.R.A.F. so that they could take over clerical and administrative tasks at present performed by National Servicemen, the Air Minister replied: "We want at least to double the size of the W.R.A.F., and we are urgently considering plans to this end."

Export Progress

EQUIVALENT to an annual rate of more than £105m, British aviation exports for the first six months of this year totalled £52,869,228.

The June value, at £9,910,307, was the second highest monthly total of 1957, and the fourth highest ever achieved. Aircraft and parts accounted for just under £6m and engines for £3.4m.

Air Operations in Oman

ON Wednesday of last week, following a series of warnings by leaflet to the rebels—followers of the Imam of Oman—defying the Sultan of Muscat and Oman, the R.A.F. went into action against their strongpoints. Venoms from Sharjah (on the Trucial Coast some 300 miles to the north) flew 12 rocket sorties against a mud-brick fort with walls 5ft thick, at a place named Izki. "Attacks were concentrated on the roof of the inner structure," said an official communiqué, "and a Meteor reconnaissance pilot who flew over the area immediately after the final strike reported that the fort was gutted and that there were signs of severe damage to the ramparts."

On the following day the target was a big fort at Nizwa, the rebel H.Q. in the heart of the Oman mountains, where Venoms of No. 8 Sqn flew 12 apparently successful rocket-and-cannon sorties. Attacks were also made against a smaller fort.

Meanwhile a precautionary build-up of British Army strength was taking place at Sharjah, whence troops had been flown from Kenya in R.A.F. Beverleys. A newspaper correspondent there reported seeing, beside the Venoms, several transport aircraft, a Shackleton and a Canberra.

On Friday it was thought that the insurgents were losing heart, and R.A.F. action was suspended. "We are waiting to see which way the wind is blowing," said a British official spokesman. Intensive reconnaissance flights were made, and leaflets were dropped calling upon the rebels to surrender.

By the week-end, however, it became apparent that the morale of the dissident Imam's forces had not been so badly shaken as at first thought, and a heavier "demonstration" was accordingly laid on. Whereas only four Venoms had been attacking at any one time, on Monday ten went into action against a fort at Birkat, five miles east of Izki. The nearest houses were half a mile away, and a leaflet warning preceded the attack. Pilots reported "considerable damage" to the walls of the fort.

The air operations are under the command of A.V-M. L. F. Sinclair, C-in-C. British Forces Arabian Peninsula.

Wright Memorial Lecture

THE 45th Wilbur Wright Memorial Lecture, to be given in London on September 13 under the auspices of the Royal Aeronautical Society, will be delivered by Dr. Clark B. Millikan, Hon.F.I.A.S., F.R.Ae.S., of the Guggenheim Aeronautical Laboratory, California Institute of Technology. His subject will be *Advanced Education and Academic Research in Aeronautics.*

Before the lecture, as is customary, a number of the Society's medals and awards will be presented. Among the latter will be an Honorary Fellowship for Prince Bernhard of the Netherlands, who hopes to be present in person to receive the diploma.

The R.Ae.S. says that the sixth Anglo-American Aeronautical Conference (September 2-13) promises to be well supported. At least 100 members from the United States are expected.

Blood Brothers

THE U.S. Army has named its helicopters, flying platforms and fixed-wing aircraft after Indian tribes. Thus, the Cessna YH-41 helicopter is the Seneca—after one tribe of the six-nation Iroquois League. The Bell H-13 becomes the Sioux; the Sikorsky H-19 the Chickasaw; the Vertol H-21 the Shawnee; the Hiller H-23 the Raven; the Sikorsky H-34 the Choctaw; the Sikorsky H-37 the Mojave; and the Bell H-40 the Iroquois. Hiller's flying platform will be the Pawnee. Among fixed-wing aircraft the Beech L-23 is now the Seminole, and the DHC-4 is the Caribou. The forthcoming high-performance Grumman observation aircraft will be the Mohawk. Unchanged are the names Bird Dog, Beaver and Otter.

Napier Forms U.S. Subsidiary

UP to the present, Napier interests in the United States have been looked after by technical representatives. Now, however, with growing business interests there, D. Napier and Son, Ltd., have decided to form an American subsidiary. Known as Napier Engines, Inc., it will have its headquarters in Washington.

President is Mr. H. Sammons, C.B.E., M.I.Mech.E., F.R.Ae.S., Napier's managing director, and the executive vice-president is Mr. J. C. K. Shipp, who has long been resident in the United States to represent the aviation interests of the English Electric group, of which Napier is a member.

Mr. L. O. Brooks and Mr. A. Gualtieri, formerly Napier representatives, are executives of the new company, the former to look after matters relating to the Deltic diesel engine and Napier turboblowers, and the latter those relating to Napier's aviation interests.

No Australian F-104s

AUSTRALIA's Defence Minister, Sir Philip McBride, after reporting to the Cabinet on his recent mission to Washington, stated on July 25 that the Government has abandoned plans for building F-104 Starfighters for the R.A.A.F. Experts had advised him that the Starfighter was "too complicated for the needs of the R.A.A.F." He added: "A replacement aircraft with the special characteristics of high performance, long range and operational versatility does not yet exist, although one is in course of development."

The statement added that the Commonwealth intended to buy twelve C-130 transports as part of her plan to create a mobile striking force. Avon-Sabres would continue to be built in Australia to fill the gap until the arrival of "a fully developed American supersonic fighter."

Lined-up for Farnborough

A BIG grandstand, to seat 2,000, is under construction for the S.B.A.C. Show at Farnborough, now only a little over a month ahead. The main structure of the vast steel-and-canvas exhibition building is well advanced, and the spectator-terraces, introduced last year, are being extended. Bigger, too, is the open-air equipment park, and work is well advanced on the site for the guided-weapons enclosure: missiles, some of them on their launching ramps, are to be displayed in quantity for the first time. Meanwhile, the day-to-day work of the R.A.E. continues.

***THE PAST PRESENTED** for Princess Margaret on her inspection of the Central Flying School, Little Rissington, on July 24. Here Her Royal Highness is inspecting a Bristol Fighter; earlier she had been interested to see an Avro 504—of the type on which her father was taught to fly.*

The exhibition and display begin on Tuesday, September 3. Attendance on the Tuesday, Wednesday and Thursday is restricted to the S.B.A.C.'s guests from at home and abroad; on the Friday, Saturday and Sunday the show is open to the public. For the Friday (only) advance bookings may be made through the usual agencies or through Auto Parks, Ltd., 1 Maclise Road, London, W.14 (adults, 20s; children under 14, 10s; cars, 20s). For the Saturday and Sunday, with "popular" prices, there is no advance booking. Further details will appear in *Flight* between now and show week.

Skeeter's Turbo-blown Gipsy Major

THE Mk 12 version of the Saunders-Roe Skeeter, in production for the R.A.F., British Army, and Federal German Army and Navy, is to be available with an exhaust-driven turbo-supercharger enabling rated power to be maintained in all climates up to at least 4,000ft. Alternatively, a methanol-injection system can be employed which maintains rated power at sea level in all air temperatures up to tropical conditions.

The supercharged version of the D.H. Gipsy Major 215 increases the Skeeter's free-air hover ceiling from 2,500ft to 7,800ft, and absolute ceiling from 14,000ft to 17,800ft. Endurance and range are slightly reduced, and normal all-up weight is increased from 2,200 to 2,250 lb.

CF-100 Statement

STRUCTURAL soundness of the Canadian Avro CF-100 is the subject of a statement by R.C.A.F. headquarters in Ottawa. The announcement is a sequel to rumours which followed an accident to one of these aircraft during a display at Kinross, Mich, on May 26 last.

Thorough tests of each CF-100 by both manufacturer and R.C.A.F., plus flying experience with the Mk 5 since it went into squadron service in early 1956, have shown the aircraft to be structurally sound, says the statement. It adds: "Some time after the Kinross accident, the maximum allowable speed at low altitudes for the Mk 5 was reduced. This was not related in any way to wing-strength factors. It was due to a control characteristic in the previous speed-range that might allow the pilot unwittingly to perform too rapid a manœuvre."

Miles M.100 Centurion

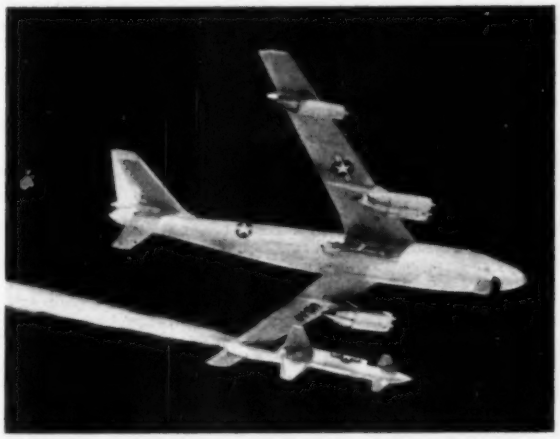
TWO higher-powered versions of the Miles M.100 jet trainer have been announced by F. G Miles, Ltd., of Shoreham. They will be powered by the Turboméca Gourdon and Arbizon turbojets, and will be known as the Centurion range (M.100 Mks. 4 and 5) to avoid confusion with the Miles M.100 Student powered by Marboré or Palas engines.

Estimated performance figures for the new versions include the following:—

M.100 Mk 4 Centurion—one Turboméca Gourdon turbojet of 1,405 lb thrust (take-off), 1,545 lb (emergency), 1,270 lb (max. continuous): time to 10,000ft, 3 min (emergency power), 3.6 min (take-off power), 4.3 min (max. continuous power); time to 20,000ft, 6.9 min, 8.2 min, 9.7 min.; best climbing speed (take-off power), from 225 m.p.h. at sea level to 265 m.p.h. at 30,000ft; max. speed at 25,000ft, 380 m.p.h. (max. contin.), 430 m.p.h. (emergency); stalling speed (flaps down, sea level), 73 m.p.h.

M.100 Mk 5 Centurion—two Turboméca Arbizon turbojets each of 550 lb thrust (take-off), 440 lb (max. continuous): time to 10,000ft, 5 min (take-off power), 8.5 min (max. continuous power); time to 20,000ft, 12 min, 21.5 min; best climbing speed (take-off power), from 205 m.p.h. at sea level to 245 m.p.h. at 30,000ft; max. speed at 22,000ft, 300 m.p.h. (max. contin.), 355 m.p.h. (take-off power); stalling speed (flaps down, sea level), 73 m.p.h.

GYRON JUNIOR/CANBERRA: Now airborne in the port nacelle of this English Electric Canberra is a de Havilland Gyron Junior. Note the shorter nacelle and shrouded tailpipe. This particular Canberra was formerly used for Avon development work at Hucknall. Later this year a second Gyron Junior will be installed. The aircraft is expected to be among the de Havilland "stable" at the S.B.A.C. Display.



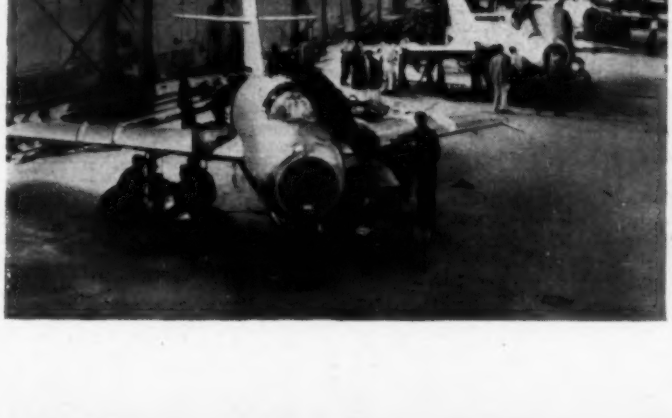
RASCAL, the rocket-propelled stand-off bomb developed for the U.S.A.F., is here seen being launched from a Boeing B-47.

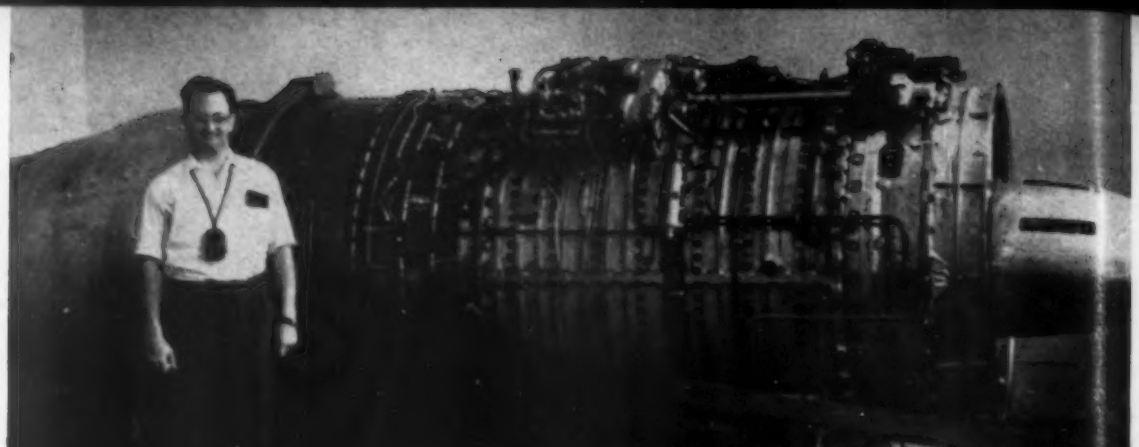
The Beverley and the Future

IN his address to shareholders, circulated in advance of the a.g.m. on August 8, the chairman of Blackburn and General Aircraft (Mr. Eric Turner) speaks of the present progress and future prospects of the Beverley transport.

After recording that three squadrons are now in being ("great credit is due to our staff and workpeople for the clockwork precision with which the delivery programme has been met") Mr. Turner goes on to examine the implications of the Defence White Paper. It seems possible, he says, that the proposed changes may increase the demand for the company's aircraft products rather than lessen it: "The White Paper referred to the creation of a Central Reserve to be based in this country, and it is difficult to

MIG ASSEMBLY in China is seen on the immediate right. These Mig-17s are the first jet aircraft to be built in that country, and one, with its pilot, is shown in close-up. Note the system of wearing the unit marking and serial number on the forward fuselage.





FORETASTE of a most important series of "Flight" articles on Soviet civil aviation is this picture of their author—Mr. Clive Jenkins—at the Kiev Voroshilov Civil Aviation College, where Soviet engineers are trained to degree standard. Mr. Jenkins is seen with the mighty turbojet which powers the Tu-104. He was the leader of a recently returned delegation from the Airways Section of the Association of Supervisory Staffs, Executives and Technicians. The thrust of the engine was quoted to Mr. Jenkins as 19,300 lb and the overhaul life as 300 hr, though this last figure is "about to be sharply increased." In size, the unit compares with the de Havilland Gyron (pages 163-168 of this issue).

FROM ALL QUARTERS . . .

imagine how it can be effective unless additional orders are placed for aircraft to move the troops and especially their equipment, for which purpose the Beverley and its successors seem particularly suitable. For financial reasons it is almost inevitable that R.A.F. Transport Command will be too small to deal with all the emergencies it may be called upon to meet, and it is therefore essential that the Government should take steps to encourage commercial operators, here at home, to use aircraft suitable for military purposes.

"It should, however, be realized that military transport aircraft, if they are to be effective, must be suitable for dropping paratroops and heavy equipment and be able to operate from secondary airfields as well as carry worthwhile payloads for long ranges. The present fleets of either the State corporations or the independent operators cannot meet these requirements.

"For these reasons, and because of the impending creation of a Central Reserve, we have again put forward to the Service departments our proposals for the design and manufacture of a version of the Beverley powered by four Rolls-Royce Tyne engines which could be in service by 1962, by which date conscription will have ended and the need for mobility of the Central Reserve have become imperative."

In a reference to the N.A.39 carrier-borne strike aircraft, Mr. Turner quotes the allusion in the recent Navy Estimates to "this formidable addition to the striking power of the Royal Navy," and adds: "We have great hopes that it will become a most successful aircraft, and, moreover, it seems suitable for use with the Royal Air Force, NATO and Commonwealth countries as either a land or ship-based bomber. We believe that in its class it will prove to be better than anything else in the world, and it is not without interest that as part of defence aid the United States Government is bearing some of the cost of development of the aircraft and will also provide a large amount of equipment, of a type not available in this country, to assist rapid and effective flight testing."

The financial section of the chairman's statement shows that after all charges other than taxation the company's profit (to March 31, 1957) has passed the million-pound mark for the first time. After provision for income tax and profits tax the net figure is £514,356, as against £382,062 for the previous year.

Growth of profits during the post-war period, the increasing net dividends paid, and the increasing sums retained annually "to finance the growth and diversification" of the company's activities, are lucidly illustrated by a graph—one of several in an attractively presented and well illustrated report.

Anglo-French Radar Co-operation

AN agreement has been announced by which the Compagnie Française Thomson-Houston (C.F.T.H.) and Decca Radar, Ltd., are to co-operate in the design and production of radar equipment for NATO air defence. The agreement also covers co-operation between Decca Radar and the C.F.T.H. subsidiary Société Nouvelle d'Electronique in aerial systems developed by Société R.B.V. Radio-Industrie. The result will be the combination of British radars with French aerial systems to produce high-performance equipment for both military defence and civil surveillance.

The electronic branch of C.F.T.H. now employs 6,000 people and is well known for both original design and efficient quantity production.

Both at the recent Salon in Paris and two years ago, R.B.V. Radio-Industrie showed a feeder-horn system for a radar scanner which produced in effect a three-dimensional scan. This was presented on two tubes in the form of plan-position and height-indicating displays.

Windfinding Radar for Argentina

FROM Decca Radar, Ltd., also comes news that the first of a series of Decca windfinding radars for the Argentine National Meteorological Service has been received in Buenos Aires. Designed for upper-air windfinding, these are claimed to be the only equipments of their type available in the world today. Those ordered by Argentina will be used to form a network of upper air windfinding stations able to provide data from heights up to 100,000ft.

Radio on Show

AT their New Southgate, London, factory Standard Telephones and Cables, Ltd., recently staged a private exhibition of their products, both aeronautical and general. Among important air radio exhibits were the new V.O.R. high-precision ground beacon which will considerably increase the present accuracy (±5 deg) of normal V.O.R. systems. An extra aerial system is added to the beacon, a small additional "black box" in the aircraft being used to sense the more precise signals. Aircraft not so fitted can continue to use the simple V.O.R. facility.

The new commutated antenna direction-finding aerial, probably the most important development in this field since the Adcock aerial, was also shown in its U.H.F. version, comfortably giving C.R.D.F. V.H.F. bearings from London Airport control tower. The STARN-21 and STURN-3 air and ground elements of Tacan were shown, together with a comprehensive range of ground and air communications equipment for H.F. and V.H.F. wavebands. The F.M.C.W. radar altimeter used for hundreds of successful blind landings at B.L.E.U., and a single-side-band radio sold against American competition in New York were displayed.

"Flight", Missiles and Navaids

IT is gratifying that continuing acclaim, by American and other authorities, of our special "Guided Missiles" number (December 7, 1956) and of a companion issue dealing with Flying Aids (April 12, 1957) should still be accompanied by requests for additional copies and for permission to utilize subject-matter in official works of instruction and reference. Such was the demand for the "Guided Missiles" number that it was out of print within a few days of publication.

In coverage of new missile and navigation techniques this journal can fairly claim to have established itself as the principal authority in this country; and very extensive newspaper and radio "quotes" in the U.S.A. are acknowledgments of ever-widening international acceptance. Recent "firsts" in the navaids field were our description of the Marconi Doppler navigators (July 12, 1957) and the exclusive article on France's Radio Mailles (July 19, 1957).

To the many readers who have been so kind as to express approbation of these features we confidently promise more of a like nature in the months ahead. These are not merely in mind; they are clearly in view.

The Commons Debate Civil Aviation

WE refer in a leading article to the Commons debate on British civil aviation on July 22, and below are points from the debate which, we feel, give a fair summary of each side's point of view. For quick reference the points are recorded out of their chronological order.

For the Opposition:—

MR. IAN MIKARDO: "On more than one occasion we have raised the question of the erosion of the Corporation's services by feather-bedded concessions given to private operators. On each occasion we were assured that the last concessions which had been made were the last concession to be made, yet each time we found later that more concessions were made to private operators at the expense of the Corporations.

"In about eighteen months' time most of the Colonial-coach services are bound to disappear in favour of a new level of tourist services. It was because of this that the Minister referred the question of those services to the Air Transport Advisory Council. . . . In a manner which one would call cowardly if one was speaking anywhere but in the House of Commons, he got the A.T.A.C. to do his dirty work for him.

"The Minister is now to do two things. The first is that the independent operators will be allowed to use better aircraft, thus directly violating the principal safeguard given to B.O.A.C. against unfair competition. The second is that after the new tourist services come into operation Airwork and Hunting-Clan are to be given 30 per cent of the traffic on the East African and West African routes, including the mail traffic formerly reserved entirely for the Corporation. Why has the Minister gone back on his predecessor's undertaking? [That there was to be no material diversion from B.O.A.C. first-class and tourist-class services.] Will the Minister say that 30 per cent knocked off is not a material diversion?

"Members may wonder why the workers were so suspicious? [of last year's B.O.A.C. appointments, and in particular of Mr. Gerard d'Erlanger as chairman]. Perhaps it was because some of them noticed that the Minister had chosen to recruit his new chairman from the board of a company which finances the purchase of aircraft by private operators, including foreign operators. [Mr. d'Erlanger later denied that Air Finance, Ltd., deals with British private operators.]

"Death by a thousand cuts is just as much a death as death by decapitation. Erosion can destroy just as surely as explosion. . . . The Minister's assurance, like a lot of his other statements about the Corporation, is a specimen of that peculiar brand of 'double think' and 'double talk' that he always uses when he talks about civil aviation. I am quite sure that in the Ministry there is a slogan on the wall which says 'Erosion is Construction'.

Warning to Private Operators

"I believe that there is place for both public enterprise and private enterprise in civil aviation. . . . If the Labour Government which will be returned at the next election find themselves compelled to make drastic changes it will be entirely the fault of the Right Hon. Gentleman and his colleagues and predecessors. If the private operators exercise ordinary business prudence they ought to bear in mind before they enter into any further serious commitments that the Right Hon. Gentleman will not be in office forever and that he may very well be gone before many months have passed."

MR. A. E. HUNTER: "I have met many of the Corporation's employees in their trade union branches. One point which has always impressed me has been the keenness of the staff to make these Corporations a great success in every way. To them it is not merely a matter of wages and working conditions . . . I have seen that they are proud of B.O.A.C. and B.E.A. and are very keen to make these great Corporations the best in the world.

"I have been assured that . . . private capital could not handle the needs of the expansion of B.O.A.C. and B.E.A.: for example, the long-term programme of buying aircraft for 1965 and the vast capital required for airports and developments . . . I have been assured that the industry could be handled in the great way in which it is expanding only by the public Corporations.

"It may be that what the Minister is taking away in traffic is a small percentage, but the employees have formed the impression that this is the beginning and that, while he may take away only a few thousands one year, in the years ahead he may take away several millions.

"I appeal to the Minister not to take action that will weaken the Corporations and not to give the impression to the staff that he is not behind them in their great efforts to make the Corporations the best and safest in the world."

MR. A. FENNER BROCKWAY: "When the nation has constructed a great national service in which every one of us have great pride, when we have among the workers in that service a devotion to it and the devotion to the national cause which is reflected in it, it is a betrayal of national interest if we limit the powers which that great national service has. . . . We have among those men a wealth of enthusiasm for their task. They have almost the spirit of the old craftsmen who loved to do what they were doing."

MR. FRANK BESWICK: "The Minister is making a proposal contrary to the Air Corporations Act, 1949. He is proposing a policy which is illegal. . . . The Air Transport Advisory Council is now being required to undertake responsibilities for which it was never intended. The Minister has been sheltering behind recommendations made by the A.T.A.C. He suggests these carry weight which must be accepted by him. In fact, it is not so. The A.T.A.C. has no locus in this matter at all.

"One concession leads only to further concessions. I recall the case of the car ferry service. What happened? Once it had a licence—and on this understanding an assurance was given to the Corporation, which was interested—it said, 'We are carrying these car passengers. Surely we can be allowed to carry additional passengers as well in order to make the service economic.' One gives way when one is faced with logic of that kind. The argument is impeccable. They were permitted to carry a limited number of passengers. I speak from memory—I think the number was six. After a time, they come back and say, 'You have accepted the principle. We can now carry passengers other than the car passengers. You limited us to six; we have space for ten. Why do you prevent us filling the four empty places?'

"We see again this technique of one limited concession making another impossible to resist. . . . Once international scheduled services are allowed to private enterprise, what is the logical answer to the ultimate request that instead of two routes they should be allowed to operate three or four? The economics of the argument would be absolutely unchallengeable.

"It seems to me that the next logical step would be for parallel services across the North Atlantic. If we look further ahead, when we have these independent companies running parallel services alongside B.O.A.C. services in different parts of the world, we shall have them coming along and calling our attention to the uneconomic character of these duplicated services. They will say that the next step must be a merger between the independent operator and the Corporation.

"This is the policy which all these people want—an opportunity to invest in the national chosen instrument . . . I am suggesting that they are moving step by step towards the position in which they can [do so] with some chance of success. The shipping interests . . . are today asking for the opportunity to put capital into a monopoly air transport route.

Bulk Traffic of the Future

"I maintain that these proposals have the worst of both worlds, neither the advantages of competition nor the advantages of unified operation. They will mean overlapping in services and facilities, they will mean an increase in overheads, and they will mean more expenditure in the development in these African services.

"We are now dealing with a class of tourist traffic which I believe will be the bulk traffic not only in Africa but in other parts of the world . . . we are not dealing here with something which these [private] companies pioneered."

For the Government:—

MR. F. A. BURDEN: "In 1955 and 1956, when British aviation carried 13.6 per cent of the world's traffic, 0.8 per cent only was carried by the independents. It is estimated that the independents on this particular service will carry between 4,000 and 5,000 passengers a year. It is suggested that this will break the great Corporation . . . with all the wealth they have, with the opportunities they have of coming to this House and getting grants, with their opportunities under Government sponsorship of buying the newest aircraft in the world, with their giant organizations, the publicity officers, their offices through the world, will those 4,000 to 5,000 passengers a year mean such a terrible thing for the Corporations?

"If it is to be determined that the Corporation shall carry 70 per cent of the traffic and the independents 30 per cent, who will determine how that is to be arranged and fix the density that is to be given to each operator, and so on?"

MR. PAUL WILLIAMS: "I suggest that to cry 'wolf' at this stage is prejudging a policy whose details are at the moment remarkably uncertain. I come to the conclusion on the alteration that the independents are losing a proportion, and quite a severe proportion, of the traffic which they pioneered, in which they risked their all, and are being forced to let go this traffic to a Corporation which previously had shown little interest in this field."

DR. R. BENNETT: "I think that the Corporations could be given Parliament's enthusiastic support in trying to make themselves more financially efficient. A figure of 0.8 per cent net profit is surely not a very good business outcome. . . . We are dealing with the traffic which was unwanted by B.O.A.C. and was developed at the risk of the shareholders moneys by private enterprise. . . . The Corporations are to be given 70 per cent of somebody else's business.

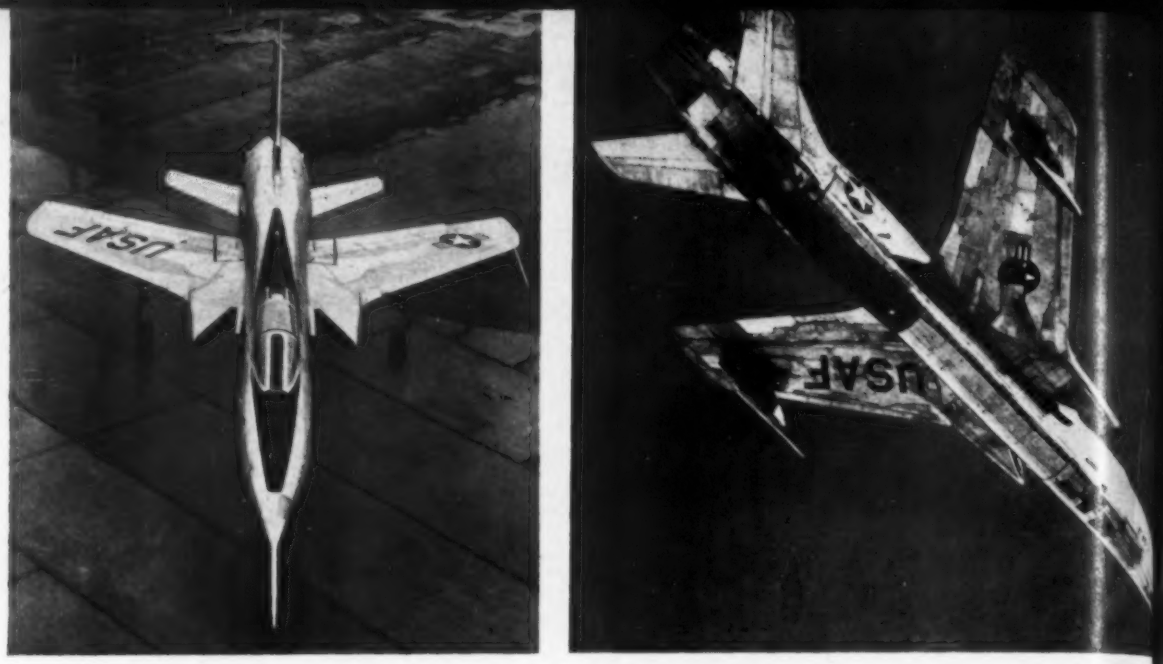
"I imagine that the Opposition wants all the future development in operating civil aircraft in this country to be substantially in the hands of the nationalized Corporations only."

The Minister Replies

MR. HAROLD WATKINSON (Minister of Transport and Civil Aviation): "I have sat here during the whole of this debate in, at times, some astonishment, because I have wondered how remote can Hon. Members get from the outside world. What matters is not that what the Socialist Party or the Conservative Party decides in air transport, but what the pattern of air transport in the world dictates. Unless we take some account of that, we shall do great harm to the Corporations as well as to the industry as a whole. What is proposed is not a change of policy in any way. At most, it is a development of existing policy. It is, at most, simply a piece of elementary justice to allow the airlines concerned to keep the traffic which they themselves have created.

"I do not make any apology for referring this matter to the A.T.A.C. I should like to see the status and standing of the A.T.A.C. constantly improved. In my view, we need a licensing and arbitrating body in this growing industry. I believe that the A.T.A.C., under Lord Terrington's distinguished chairmanship, fulfils the task impartially and supremely well. The advice that the A.T.A.C. gave to me was impartial advice within the terms of the Act.

(*Concluded on page* 177)



ATTACK, RECONNAISSANCE, FIGHTING are the missions foreseen for the Republic F-105 Thunderchief, subject of these striking new views. Notable design features are the swept-forward air intakes, for optimum supersonic performance, and a four-piece air brake at the rear of the fuselage. Note in the right-hand view the massive underwing stores-pylons positioned far outboard.

HERE AND THERE

Skylark No. 3

A SUCCESSFUL test launching of a Skylark rocket, carrying prototype sounding and radio equipment, was made at Woomera on July 23. It was No. 3 of the series of British vehicles for the I.G.Y. experiments (see col. 2, page 154, this issue).

23,000-ft Delay

AN unofficial record is claimed for parachutist Jean Coupe, who, without oxygen, jumped from 24,500ft near Toulouse on July 25. He fell to within almost 1,600ft of the ground before pulling his rip-cord.

E.P.9 on Floats

THE first Edgar Percival E.P.9 to go to Canada is now on its way to North West Industries, Ltd., who will fit floats and use it for general passenger and freight work. It is a six-seat version with upholstered and soundproofed cabin.

Commonwealth Exercise

DURING the second week in August, Commonwealth ships and aircraft will be assembling at Trincomalee for the annual joint exercise, which has been held there for the last seven years at the invitation of the Ceylon Government. Sunderlands of No. 205/209 Sqn. will be participating, and both India and Pakistan are contributing air as well as naval forces. The exercise, due to last five weeks, will be directed by the C-in-C. East Indies, Vice-Admiral H. W. Biggs.

Dunked Detection

FIRST public demonstration in this country of the dipping-asdic method of submarine detection will be given by a Fleet Air Arm helicopter at Chatham Naval Days (August 3, 4 and 5).

Pakistan Command

AT Karachi on July 23, A.V-M. A. W. B. McDonald formally handed over command of the Royal Pakistan Air Force to A.Cdre. M. Asghar Khan who is promoted to Air Vice-Marshal. On behalf of the H.Q., the latter presented an R.P.A.F. badge to A.V-M. McDonald, who is the last British officer to have commanded any of Pakistan's armed forces. He has now been appointed A.O.C-in-C. Technical Training Command (see page 173).

Djinns for U.S.A.F.

IT is reported that the U.S.A.F. has signed an order for three Sud Aviation Djinn helicopters for delivery from France towards the end of this year.

W.J.A.C. in Camp

THE annual camp of the Women's Junior Air Corps opened at Hurn Airport last week-end. Eight women pilots are assisting as instructors, and the three aircraft include the Corps' newest, a Miles Messenger.

Helicopter Association Executive

DR. G. S. HISLOP has been elected a vice-president of the Helicopter Association, following the election of Lt-Col. J. W. Richardson to succeed him as chairman. The other vice-president is W/C. R. A. C. Brie (re-elected). This information amends an announcement in these pages last week.

Compact Power

MANUFACTURED by Solar Aircraft "under contract to Rocketdyne for an advanced propulsion system now under development," an air turbine of only 10in diameter and 15in length is said to "develop more horsepower than a nine-ton diesel engine." It is to drive fuel pumps.

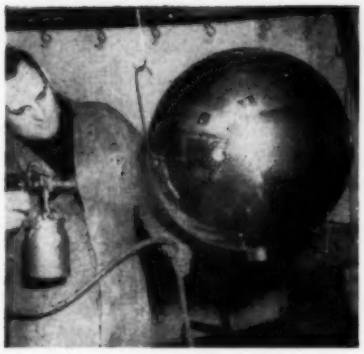
Air-Britain Meeting

AT the August 7 meeting of Air-Britain a member's 70-minute colour film of the Paris Aero Show and a Sikorsky S-58 trip from Brussels to Paris will be shown; and Mr. Peter W. Brooks (technical assistant to the chairman of B.E.A.) will give an illustrated talk on *Vickers' Transports, 1920-1960*. The meeting is at Caxton Hall, London, S.W.1, and starts at 7 p.m. Visitors will be welcomed.

A GRADUATION ceremony held at Queen's University, Belfast, saw aeronautics well represented. Mr. G. W. H. Gardner (left), Director of the R.A.E., was awarded the honorary degree of Doctor of Science. He is seen here with Mr. David Keith Lucas (right), director and chief designer of Short Bros., who is a member of the Senate, and Prof. A. V. Stephens, Head of the Department of Aeronautical Engineering at Queen's.

Rockets and Satellites at Cranfield

The Papers and Discussions Summarized



The U.S. satellite Vanguard. It is seen receiving a coating to protect its surface during transit.

AS briefly recorded in these pages last week a symposium on high-altitude and satellite rockets was held from July 18 to 20 at the College of Aeronautics, under the joint sponsorship of the Royal Aeronautical Society, the British Interplanetary Society, and the College. It was attended by workers and enthusiasts from many parts of the world, including Prof. Boris Petrov of the U.S.S.R. Academy of Sciences (who made a statement on the Russian rocket and satellite programme for the International Geophysical Year), Mr. Milton Rosen of the U.S. Naval Research Laboratory, Mr. K. J. Bossart of Convair, and Lt-Col. J. P. Henry of the U.S.A.F. Air Research and Development Command. A heartening token of the interest that the British Government takes in rockets for peaceful uses was the presence of many senior representatives from the Ministry of Supply, including the Director of the R.A.E., Mr. G. W. H. Gardner.

The papers presented ranged over an admirably wide field of endeavour. The matter-of-fact, but fascinating, description by Mr. Rosen of the Vanguard launching vehicle, with its candid admission of the ignorance that still exists about the behaviour of rocket systems and the atmosphere they have to pass through, and the review by Dr. L. R. Shepherd of Harwell of future developments in rocket propulsion, covering the utilization of nuclear energy to take a manned vehicle to the Moon and back, showed a stimulating contrast between our present and future capabilities. The problems of structures and of the well-being of the crew were considered by Mr. K. J. Bossart of Convair and by Dr. H. G. Clamman and Lt-Col. J. P. Henry of the U.S.A.F. Mr. Bossart made the comforting suggestion that it will be easier to make vehicles of 100 tons launching weight, to give a specified performance, than small rockets like Vanguard, and Dr. Clamman and Lt-Col. Henry suggested that even in a sealed cabin in an orbit it should be possible to keep the crew healthy and sane.

Considering the papers in more detail, they may be divided into groups concerned with various aspects of the main subject.

The current work on atmospheric exploration, in its different aspects, was considered in papers by PROFESSOR H. S. W. MASSEY of University College, London, MR. MILTON ROSEN of the U.S. Naval Research Laboratory, and MR. W. H. STEPHENS and DR. A. W. LINES of R.A.E. Farnborough. PROF. MASSEY, whose lecture *The Scientific Application of Rockets and Satellites* opened the symposium, pointed out that the use of rockets for upper-atmosphere research made possible observations which could never be done from ground stations or balloons, and that direct measurements could often be made instead of indirect ones. Also, experiments, rather than mere observations, could be performed, such as the liberation of nitric oxide at high altitudes. He said that the properties which could not be studied with ground based equipment included, first, the solar spectrum. The Earth's atmosphere acted as a filter which cut off all radiation with wavelengths shorter than 2,900 Angstrom units, and this meant that part of the solar spectrum, the far ultra-violet and X-rays, was invisible from the ground. Techniques for measuring the spectrum from rockets included the use of spectrographs which had either photographic or photoelectric recording, thermoluminescent phosphors with filters to isolate particular wavelengths, and photon counters.

Secondly, the ionosphere could not be completely studied from the ground (by radio waves) since reductions in electron density with altitude would be "hidden" by the lower peaks in density. Rocket techniques could measure the refractive index (and hence the electron density) at a chosen frequency over a great height range, and measurements could be made of the positive ion concentrations, although the presence of the rocket and its exhaust made this difficult.

The ionosphere also contained the dynamo currents, which circulated about the Earth at great heights. These currents were connected with the Earth's magnetic field and the auroræ, and could be measured by flying rockets fitted with magnetometers. Knowledge of the magnetic behaviour of the Earth, particularly in the rapid phenomena of magnetic storms, was as yet scanty.

The last of these measurements which could not readily be made from the ground was that of the heights of the atmospheric layers which produced the faint airglow. Ground-based observations had given an extremely wide range of results, and the matter could be resolved only by flying photometers with suitable optical filters.

Superiority of rocket observations in those fields which were also amenable to ground observation was due to the directness of the methods which can be used. For example, the variation of temperature with altitude could be studied from the ground by measurements of the anomalous propagation of sound, of the atmospheric tides, and of the observed thickness of the E layer, but by grenade-firing techniques the velocity of sound from different altitudes could be measured directly by observing the time interval between the reception of the flash and the bang from a particular grenade. The temperature followed very simply, and pressure measurements could be made with existing aerodynamic techniques, at least to altitudes of 100 km. Above this altitude the background pressure of the rocket became too great, and since the atmospheric molecular weight altered by the dissociation of oxygen, the relation $p=\rho RT/M$ could no longer be used.

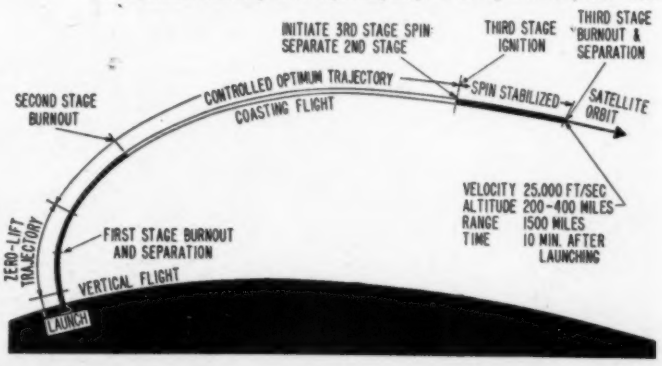
Regarding experiments, rather than observations, Prof. Massey noted the way in which sodium vapour or nitric oxide could be liberated at high altitudes to glow under solar excitation. Luminous clouds such as these afforded a means of estimating the amount of the material concerned which was present in the atmosphere, and they could also be used for measuring winds, since they were electrically neutral.

Rocket techniques, valuable as they were, had intrinsic limitations, notably the short duration of flight and the difficulty of getting coverage of wide areas of the Earth. Satellites should overcome both these limitations, and in addition they extended the range of observations which could be made to measurements of the Earth's true shape, the air density, and the radiation from the Earth's atmosphere, as well as to really long-term studies of solar radiations, cosmic rays, and magnetic variations.

The way in which a satellite could be got up to an orbit where it could serve useful purposes was described by MR. MILTON W. ROSEN, who is technical director of Project Vanguard. In an absorbingly interesting paper, *The Satellite Launching Vehicle*, Mr. Rosen said that it was necessary to put the satellite into an orbit where the air density was always low. If the maximum altitude were 100 miles, the satellite would not perform a single orbit; at 200 miles a lifetime of a few weeks would be obtained, and at 300 miles about a year. Apart from getting the satellite to the nominal orbital altitude, the launching vehicle must give it the required orbital velocity to ensure that centrifugal force would balance the Earth's gravitational attraction. At 300 miles, this orbital velocity was 25,034ft/sec, or nearly 5 miles/sec. The

Fig. 1 (left). Initial orbit of the satellite.

Fig. 2 (right). Trajectory of the launching vehicle. Both these diagrams are from Mr. Milton Rosen's Vanguard paper.



Rockets and Satellites at Cranfield . . .

satellite was to weigh 21.5 lb, and the gross weight of the launcher would be 22,600 lb, giving a ratio of vehicle to satellite weight of over 1,000 to 1.

The most favourable method of launching would be to fire the vehicle eastwards at the equator, so that the velocity of the Earth's surface here (1,515ft/sec) could be used to augment the vehicle's velocity into the orbit; but the presence of an existing launching site and a chain of radar tracking stations had made it necessary to fire from Cape Canaveral in Florida (28° 28′ N latitude), which would give an Earth-rotation contribution of 1,170ft/sec at an inclination to the equator of 35±5°, so that the orbit would be as shown in Fig. 1.

Nominal height of projection of the satellite at launch had been set at 300 miles, with a closest approach to the Earth (perigee) of 200 miles. These requirements placed a severe limitation on the tolerances for the final projection velocity and elevation angle; but, if an excess of velocity were available, and it did not matter if the apogee distance became large (up to 1,400 miles or more), the elevation angle became less critical and so the guidance was simplified. For example, if the nominal orbital velocity was exceeded by 2 per cent, the tolerable error in elevation angle was increased from ±1½° to ±3°.

A three-stage configuration for the launcher was chosen because it would be possible to use experience on the Viking rocket for designing the first stage. A two-stage vehicle would have been simpler, but the first stage would then have been very large.

Guidance was all contained in the second stage: the presence of guidance in the small third stage would have meant a crippling weight penalty, since in this stage 1 lb of structural weight or payload was equivalent to 80ft/sec of orbital velocity, while having all the guidance in the first stage would mean that this stage would have to get to orbital altitude before sending the second and third stages on their spin-stabilized course. The guidance in the second stage was subjected to a weight penalty of 8ft/sec/lb, which was restrictive but not defeating, since a reasonably light and simple system could be used.

Mr. Milton Rosen went on to describe the main features of the three stages, which may be summarized as follows:—

Stage 1 has liquid oxygen and gasoline as propellants, fed by a turbo-pump driven by decomposed hydrogen peroxide. Thrust is 28,000 lb, with a burning time of about 142 sec. The motor is gimballed for directional control in pitch and yaw, while roll control is obtained by changes in direction of the turbine exhaust steam. Propellant tanks are integral with the structure, and are pressurized (to avoid pump cavitation) with helium, which also operates some pneumatic controls. Guidance is supplied from the second stage.

Stage 2 has pressurized propellant feed from integral tanks. Propellants are fuming nitric acid and dimethyl hydrazine, which are self-igniting. The motor has a thrust of 7,500 lb and is gimbal mounted. Tanks are pressurized by helium, and, after burn-out, the remaining gas is used in small rocket nozzles to control the orientation of the vehicle during its coasting flight. In this stage the reference system contains three gyroscopes, and a pitch programmer to control the flight-path inclination; the system gives guidance through first-stage powered flight, second-stage powered flight, and second-stage coasting flight, as well as making a computation of coasting time to predict the instant of reaching zenith of the trajectory, at which time the third stage is fired.

Stage 3 is contained, when the vehicle is launched, entirely in the nose of the second stage and is protected from aerodynamic forces and heating by the nose cone. During second-stage burning, when the vehicle is high in the atmosphere, the nose cone is jettisoned. At the appropriate time for firing, the third stage is spun-up on a turntable in the second stage, separated, and ignited. It carries the satellite at its forward end, and consists of a simple solid-propellant rocket motor, giving a thrust of 2,300 lb. The satellite is finally separated from the third-stage motor by a spring device with a mechanical timer.

The first stage provides most of the energy to get the second and third stages up to orbital altitude, together with about 15 per cent of orbital velocity; the second stage, which acts as the brain of the whole vehicle, gives the remaining orbital height and another 32 per cent of the orbital velocity, while the third stage provides the remaining orbital velocity, with an acceleration of 35g. The flight path is shown in Fig. 2.

The British Upper Atmosphere Sounding Rocket, by MR. W. H. STEPHENS of R.A.E. Farnborough, was a description of the Skylark rocket, sponsored by the Gassiot Committee of the Royal Society and designed and developed at Farnborough and Westcott: it is propelled by the solid-propellant Raven motor, which has a nominal thrust of 11,500 lb for 30 sec, and is designed to reach a height of about 500,000ft with a take-off weight of 2,500 lb. Main details are:—

Length, 25ft; body diameter, 17½in; payload weight, 50 to 150 lb; launching weight, 2,560 lb; thrust, 11,500 lb × 30 sec; velocity at burn-out, 5,200ft/sec at 60,000ft; summit altitude, 93 miles (with 65 lb payload); launcher, 80ft tower; vehicle cost, £5,000.

Made from Bailey bridge sections, the launcher permits deviations of +15° to −5° in elevation from the vertical, and of ±10° in azimuth, to allow for wind effects. The nominal launching elevation will be 87½°.

In order to increase the maximum altitude and to decrease the dispersion in direction, a boost motor is being designed which will burn for about 3 sec before separating from the rocket, and with this aid Skylark should get up to 700,000ft. Vehicles boosted in this manner will be fired from Aberporth in due course.

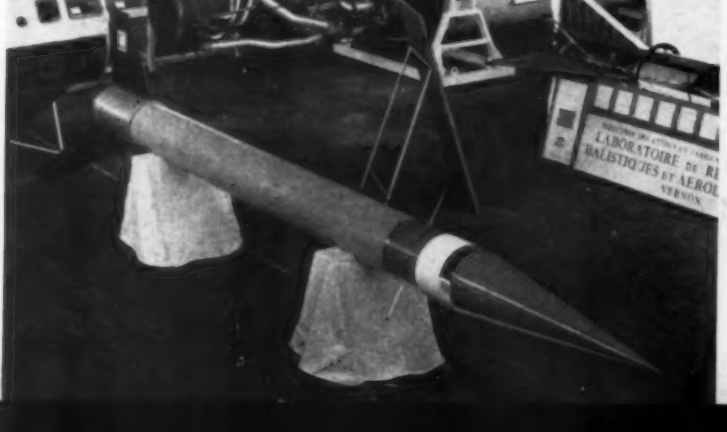
Some Problems of Instrumentation, Telemetry, and Guidance were discussed in a paper by DR. A. W. LINES of R.A.E. Farnborough which gave particular reference to the measurement of air pressures and vehicle attitude. Dr. Lines also spoke about the Skylark telemetry system and the problems of guiding a satellite into an orbit. He said that the techniques of performing experiments in an unguided and uncontrolled rocket like Skylark were conditioned to a considerable extent by the vehicle behaviour. The accelerations and vibrations during launch and powered flight were very great, although at the greatest heights there would be no vibration and little acceleration. In the absence of guidance, the vehicle might tumble and roll, so that it might be necessary to support some experiments by instrumentation measuring the attitude of the vehicle to an accuracy of a few degrees.

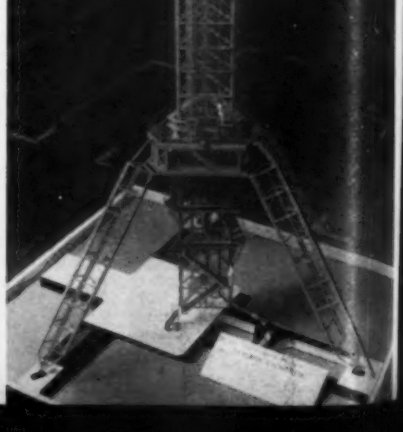
The air pressure gauges for Skylark had to cover a range from about one atmosphere to 10^{-9} millimetres of mercury, and three different types of gauge would be used. Specially developed Pirani gauges with oscillating tungsten filaments were to be used in the range 800 mm Hg to 10^{-5} mm Hg, while ionization gauges would cover 5×10^{-3} mm Hg to 10^{-5} mm Hg: in addition, radioactive ionization gauges would be used in two steps, to cover 10^{-4} mm Hg to 10 mm Hg and up to 850 mm Hg.

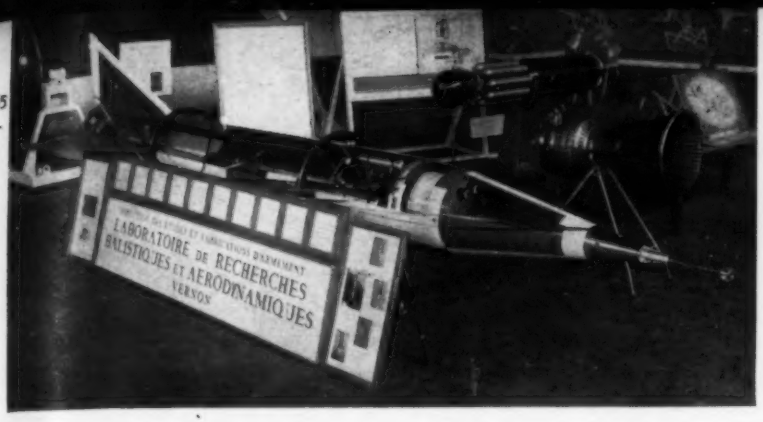
Attitude would be measured by finding the Sun's direction with three selenium photocells mounted with their surfaces orthogonal, their output being combined to indicate the direction cosine of the sunlight vector, and by noting the direction of the Earth's magnetic field with a flux-gate magnetometer: a microwave interferometer system was also being developed which would give direct and continuous indication of the attitude from ground stations.

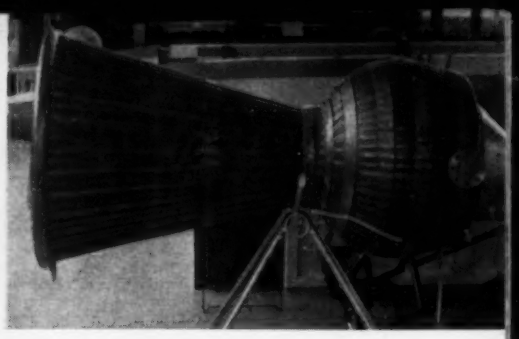
A group of papers was devoted to the crucial problem of the re-entry and recovery of satellite vehicles containing men or valuable equipment. In easily the most controversial paper of the symposium, DR. W. F. HILTON, Chief Aerodynamicist of Sir W. G. Armstrong Whitworth Aircraft, Ltd., Coventry, put forward a proposal for a re-entry vehicle in the form of a hypersonic glider which would fly with high lift and high induced drag, an absolute vacuum being produced behind it. The high lift was essential to ensure that, if a vehicle approached the Earth with a speed of more than 7 miles/sec (the parabolic velocity), it would be liable to fly away into space again if it could not be kept in contact with the atmosphere long enough to dissipate sufficient energy to enter an elliptical orbit at about 5 miles/sec, and for this it would be

The fourth British Skylark rocket, shown at Cranfield before dispatch to Woomera for its I.G.Y. firing. (Right) Model of the launching tower. "Flight" photographs









"Flight" photographs
The French Veronique sounding rocket and (right) a large liquid-propellant combustion chamber by R.A.E. Farnborough.

necessary to provide lift *towards* the Earth's surface. As the speed fell below 5 miles/sec the glider would have to do a roll to keep it from falling on the Earth, since the centrifugal force would then no longer exceed gravity.

By using sharp leading and trailing edges on a small-aspect-ratio wing, the induced drag could be kept high and the heating due to the airstream could be confined to the surface of the wing which faced forward: this surface would be designed to melt or burn away without causing extensive failure of the vehicle. The other surface would have mounted on it the life compartment and equipment, and it would be protected from kinetic heating by the presence of an absolute vacuum, caused by the flow round the edges of the wing not being able to expand into all the available space, as in the limiting case in the classical Prandtl-Meyer expansion. The vehicle would be spin-stabilized to avoid the necessity for a tail system exposed to the airstream. [Its unusual shape and attitude are shown in Fig. 3.]

Other aspects of re-entry were covered by papers by DR. N. C. FREEMAN of the N.P.L., Teddington, who put forward a theory regarding the non-equilibrium behaviour of a dissociating gas when passing through a disturbance such as a shock-wave, and by DR. P. MURRAY of A.E.R.E., Harwell, who spoke of the choice of materials for vehicle outer surfaces, proposing the use of insulating slab materials outside the vehicle proper, which would then have to be protected against thermal shock and meteoric abrasion by a thin, hard skin, either of a metal such as molybdenum or of fused silica.

Propulsion and structural design of rocket vehicles in the fairly near future formed the subjects of papers by PROF. A. D. BAXTER of the College of Aeronautics and by MR. K. J. BOSSART of Convair-Astronautics in the U.S.A. Prof. Baxter's paper formed a comprehensive review of the problems involved in getting better performance and propellants for rockets, and the choice of numbers of stages and engine size, as well as the need for optimizing propellant mixture ratios, propelling nozzle dimensions and shapes, and of adjusting the direction, velocity and acceleration of the vehicle by controls on the engine rather than by aerodynamic means.

MR. BOSSART came to the conclusion that some of the larger

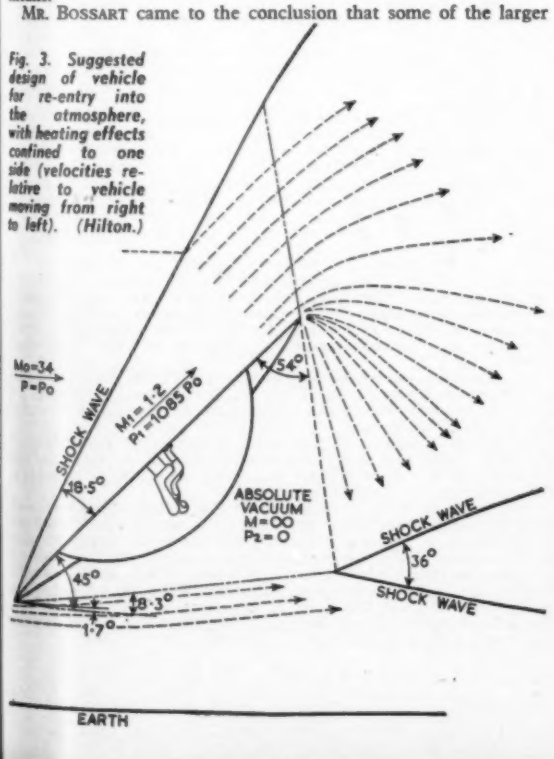


Fig. 3. Suggested design of vehicle for re-entry into the atmosphere, with heating effects confined to one side (velocities relative to vehicle moving from right to left). (Hilton.)

vehicles now being built might not be far removed from the ultimate size, for he suggested in his paper that 50 to 100 tons might well be the most efficient take-off weight from the point of view of operating economy. If it were required to put a large satellite into an orbit, this could be done by sending up several vehicles and joining them together in the orbit, perhaps for an interplanetary voyage.

The place of Man in an alien environment was discussed from two aspects by speakers from the U.S.A.F. DR. H. G. CLAMMAN, of the School of Aviation Medicine, spoke about the problems of respiratory metabolism in sealed cabins, and pointed out that it was desirable to achieve a balance in the cabin atmosphere for carbon dioxide rather than for oxygen, since, if we were considering regeneration of the atmosphere by the use of algæ, it was not possible to remove all the CO_2 without steadily increasing the oxygen content, although the latter would be quite beneficial.

If algæ were used, as they might have to be on a voyage of several months or years, the problem would arise of keeping the algæ actively converting CO_2 into oxygen: this could only be done if the algæ concentration were kept at a constant and fairly low level in the tanks, so that the light required for photosynthesis could be effective. This would mean disposing of the surplus algæ, and this could only be done by using them as food for the crew. Although algæ contained protein to the extent of 50 per cent by dry weight, it might be difficult to maintain a tasty cuisine.

LT. COL. J. P. HENRY, of the European Office of Air Research and Development Command, spoke about the mental disturbances which might be encountered when human beings were exposed to a state of isolation with negligible mental stimulus, such as might be found in a space vehicle or a satellite.

Experiments in Canada had shown that when healthy young men were kept in bed with their vision impaired by the use of frosted-glass goggles, their tactile senses frustrated by cotton gloves, and their hearing masked by a steady humming noise, all the subjects began to show symptoms of abnormality, perhaps in a few hours. They got easily angered or depressed, could not think systematically or productively, and had mental blanks: they suffered from hallucinations, which might start with dots of light in simple patterns and get more complicated, until their vision appeared to be full of little men or scenes from a film.

If the subjects were placed in a tank of water in immersion suits so as to give an effect of zero gravity, the symptoms would be worse and set in more quickly. A notable feature was the tendency for the images to swim or tilt in a nauseating manner. States such as these might be found in a satellite crew, particularly if there were little to do; but if plenty of meaningful occupation were available, together with some slight contact with a familiar environment, the very real danger might be overcome.

The final and most forward-looking paper of the symposium was given by DR. L. R. SHEPHERD of A.E.R.E., Harwell. Dr. Shepherd, who is president of the International Astronautical Federation, dealt with the requirements of propulsion systems for such tasks as making an escape rocket (in a parabolic orbit), a one-way lunar vehicle, or a returning manned lunar vehicle. He said that the first two tasks might be accomplished with chemical propellants, such as fluorine with hydrogen or hydrazine, but for the return lunar trip the take-off weight might approach 100,000 tons, at a cost of say £10^9 or £10^8, which would be prohibitive. He then went on to discuss the application of nuclear energy to rocket propulsion, by heating a working fluid (hydrogen) by passing it through a reactor which might be in the form of beds of small spheres or porous layers. Dr. Irene Sänger-Bredt had computed the performance of hydrogen as a propellant up to a temperature of 10,000°K, showing that at no more than 3,000°K an exhaust velocity of nearly 10,000 metres/sec (specific impulse of about 1,000 sec) might be achieved.

Alternatively, particularly for a journey which began from a satellite orbit, electrical methods of accelerating the working fluid could be used. Hydrogen could be passed through an intense electric arc and then expanded through a nozzle; or a fully ionized plasma, such as that of sodium, could be passed through an electromagnetic pump similar to the type used for liquid metals in nuclear reactor engineering, and so accelerated directly. The plasma would

Rockets and Satellites at Cranfield . . .

be electrically neutral, so that there would be no need for the inefficient process of separating positive and negative ions necessary when electrostatic acceleration was used.

Dr. Shepherd objected to the use of metastable or unstable chemical propellants, such as atomic hydrogen or free radicals, mainly from the point of view of hazards: a few hundred tons of atomic hydrogen would give the same sort of explosion as a "kiloton" nuclear bomb.

One of the delegates from the U.S.S.R., Dr. Boris Petrov, of the Academy of Sciences, made a statement on the proposed Russian participation in the I.G.Y. as regards rockets and satellites. The statement was made somewhat tantalizing by the lack of detail on the rockets or the satellites themselves, but it appears that the Russians are going to fire 125 rockets up to at least 200 km, from sites situated between the meridians 50° to 60° E longitude: two zones in the U.S.S.R. in Franz Josef Land (80° N latitude) and in central Russia (50° to 60° N latitude) and one in Antarctica (50° to 60° S latitude) will be used. The satellites will be launched from the U.S.S.R. and will pass over the Earth in nearly polar orbits, so that they will be observable from all over the Earth except the central polar regions. This choice of orbit makes little use of the contribution to the orbital velocity of the Earth's eastward motion which is used with Vanguard, and indicates that the Russian launching vehicle will be of very advanced design.

Research by rockets and satellites will be made into structural parameters of the atmosphere; optical properties; ultraviolet and X-ray radiation; corpuscular solar radiation and aurorae; cosmic rays; Ionospheric phenomena; magnetic field of the Earth; micrometeors and meteorites; and physical and chemical processes in the upper layers of the atmosphere.

An interesting feature of the rocket flights is the use of containers which will be separated from the vehicles at high altitudes: this will ensure that the specimens of air that are collected, and the measurements that are made, will not be affected by the close presence of the rockets and their exhaust products.

* * *

During the symposium there was an evening film show (depicting the launching of Aerobee, Skylark, and the British G.P.V. test vehicle, as well as some features of the French Trident rocket aeroplane) and a most successful dinner which helped to give "symposium" its classical meaning. Dr. Hilton showed his versatility by giving a most spirited recital on the guitar.

The symposium, the first of its kind in Great Britain, was made a resounding success largely by the efforts of the organizing committee under Prof. Baxter, and it is to be hoped that it will be the forerunner of a series of fruitful meetings of enthusiasts in a new and exciting field.

POINTS FROM THE DISCUSSIONS

THE symposium was enlivened by discussions as interesting as the lectures which provoked them. On Prof. Massey's paper, PROF. P. A. SHEPPARD (Imperial College) pleaded that in the excitement over rockets the well-tried methods should not be neglected. Indirect methods were available for many investigations, and were much cheaper than rockets: balloons could lift instruments to useful heights, and could stay there for many hours. The main aim of research on the atmosphere was an understanding of its evolution in time as well as space, and this could not be done well by rockets which often could only be launched from a relatively small number of prepared sites and which stayed up only a few minutes. From this aspect, satellites would be much more useful, but they had to be virtually outside the atmosphere to last any length of time.

DR. F. E. JONES (Mullard, Ltd.) wondered if an understanding of solar processes and effects on the atmosphere could be gained by studying nuclear fusion explosions, but it was pointed out that detailed features of the Sun, such as the corona, could not be produced on the Earth in a small, though hot, experiment.

During the discussion on his paper, Mr. Milton Rosen said that development on the components on the Vanguard launching vehicle had reached a stage where a first-stage motor had been fired satisfactorily for 2,000 sec, although only called on to fire in the vehicle for 142 sec. Asked about the re-entry of the Vanguard satellite, he said that the magnesium alloy shell would melt, but he thought there was a possibility that some of the heavier components would not vaporize, but would shatter due to thermal shock; and he gave the view that, with a somewhat thicker skin, recovery of the satellite might be possible. The Vanguard launcher would take up to 16 hours to make ready for firing, after two or three weeks' preparatory work, including static firing of the motors.

In the discussion on Professor Baxter's paper on propulsion problems, MR. J. E. P. DUNNING (R.A.E. Westcott) put forward the view that a main obstacle to improved rocket-engine design was the great lack of fundamental knowledge of the processes involved in combustion, heat transfer and the flow of hot gases. At present, in order to give satisfactory length of life, it was often necessary to sacrifice performance. He said that the "square-cube" law should hold for rocket engines, and that as our knowledge improved we could improve specific weight by using a number of smaller engines. This would also save large expenditures on test facilities, which now tended to cost far more than the device being developed. MR. A. V. CLEAVER (Rolls-Royce, Ltd.) said that reliability was of such importance that he would rather have a single large engine than many smaller but perhaps more efficient ones, owing to the failure risk with a number of engines.

Dr. W. F. Hilton's paper on the re-entry and recovery of vehicles from outside the atmosphere was easily the most controversial presentation in the symposium, and gave rise to erudite contributions from MR. D. G. KING-HELE (R.A.E., Farnborough), MR. T. NONWEILER (College of Aeronautics), and MR. M. DOWLEN (English Electric), who disputed the presence of an absolute vacuum behind the vehicle which was postulated by Dr. Hilton. It was pointed out that the effects of viscosity and finite leading-edge radius might let air pass subsonically round the leading edge, and far from having a vacuum, the pressure might be quite high; that in some tests at Princeton University in a helium tunnel at M = 15, the pressure on the base of a model was several times that of the atmosphere; and that it was not safe to extrapolate data at fairly low Mach Numbers to conditions at very high Mach Numbers. (Dr. Hilton considered the case where M = 34.)

Commenting on Dr. L. R. Shepherd's paper, MR. A. V. CLEAVER took the opportunity to discuss the motivation for our wanting to build rockets and satellites and find out what was outside the atmosphere or on the Moon. He said that this was an extrapolation of Man's urges to find out about his environment that inspired all scientific research, and which were currently so evident in the I.G.Y. This would be sufficient for all scientists and engineers and intelligent laymen, but it might be necessary to point out to those who controlled the finances that we were now in the same state, as regards the exploration of space, as the navigators who first sailed across the Atlantic. They did not know of the presence of the New World, or of the vast resources of petroleum that it hid: even when they had discovered the land and its prizes, they were unable to exploit the petroleum for lack of knowledge of the internal-combustion engine or of chemical technology. Untold possibilities lay ahead in this new field of research into the space which surrounded us. Besides this, it would be necessary to give the guided-weapons industry something to do when all the weapon programmes were finished!

THE EXHIBITION

ACCOMPANYING the symposium was an exhibition of the experiments and rocket techniques which will help to gain new scientific information during the I.G.Y. A Skylark rocket, developed by the Royal Aircraft Establishment, was on show: this was a complete vehicle which is actually to be fired, and it was accompanied by a series of exhibits to explain the instrumentation which will be installed in the forward part of the vehicle. Skylark is propelled by perhaps the largest solid-propellant rocket motor which has been made in this country.

Experimental techniques for measuring the properties of the atmosphere which were shown included the method used by Imperial College to measure the movements of winds in the upper atmosphere. Small slivers of aluminium foil about two inches long act as resonant dipole reflectors for high-frequency ground tracking radar sets. Large echoes can be received.

A working model showed the principle of the grenade experiments to measure the velocity of sound and the temperature in the upper atmosphere. Grenades were simulated by high-intensity sparks, and oscilloscopes showed how the time lag, between the flash and the noise arriving at the "ground," was reduced as the "atmosphere" in a heated glass tube became warmer.

Other exhibits included a demonstration of the way in which sodium is shot out into the air to glow by photo-excitation. A sensitive microphone, installed in the vehicle skin, detects the impact of micrometeorites: the explanatory exhibit was provided with a tin of fine sand which could be sprinkled on the skin surface. Every grain made a blip on an oscilloscope screen, even when dropped from about an inch above the surface.

The exhibits on the U.S. Vanguard satellite included a comprehensive display of photographs tracing the development of Vanguard through the Viking rocket, which forms the basis for the design of the first launching stage.

The French sounding rocket Veronique was on show in the form of a sectional model. The vehicle is propelled by an 8,000 lb-thrust rocket engine, using fuming nitric acid as the oxidant with either 85 per cent gas oil/15 per cent furfural alcohol or turpentine as fuel. These fuels are self-igniting with nitric acid. The combustion chamber has a double wall construction, the nitric acid passing through the gap between the walls as a coolant, and the injector is of the impinging-jet type. Propellant supply is by a gas generator, from the main propellants, the combustion products being cooled.

The body of Veronique is made from welded light alloy sheet, the tanks being integral. The forward portion of the vehicle contains the instrumentation and a recovery parachute. Stability at launch is given by wires from the fin tips which maintain the rocket pointing directly upwards until the velocity is high enough for the aerodynamic forces to be adequate. Veronique reached an altitude of 85 miles in February 1954.

An impressive combustion chamber for a large liquid-propellant rocket engine was shown by the Royal Aircraft Establishment, Westcott. No thrust rating was quoted, but the throat diameter was about nine inches and the overall length nearly four feet.

Modern developments in heat-resisting metals and materials were shown in exhibits of nickel and molybdenum alloys, ceramics, and graphite, and a demonstration of the striking properties of rocket propellants kept a large audience spellbound.

The Department of Aerodynamics of the College showed some of their experimental facilities: the 9in × 9in supersonic wind tunnel was demonstrated, as well as a shock tube, but one of the most fascinating exhibits was a high pressure-temperature converter which produces a stream of very hot air by blowing a supersonic stream of air at normal temperature against the mouth of a tube restricted at the far end. For a stagnation pressure of 100 lb/in², a temperature of 500° C is obtained, and if the stagnation pressure were raised to 3,000 lb/in², the temperature achieved should be in the order of 3,000° K.

TURBOPROP v. TURBOJET

Round 7 in the Controversy

By FRANK ROBERTSON

"If we are not careful," says the author, "both the Russians and the Americans will beat us into the air with the optimum transport—the big turboprop." Here the Tu-104 and the C-130 symbolize the jet v. turboprop controversy.

IN their article published in *Flight* of July 5 Messrs. Clarkson and Newman of de Havilland put forward a case aimed to show that the turbojet is cheaper to operate than the turboprop over all but the shortest ranges.

The case is developed by setting down the parameters for two hypothetical designs, one turboprop and one turbojet, and then analysing their costs. The key to the whole case is, of course, the set of parameters chosen for the two designs and presented right at the beginning in Table 1. The bulk of the article cannot be criticized, since it is a logical exposition following automatically from the parameters of the two designs. If these parameters can be shown to be wrong or unfairly matched, then the whole argument falls to the ground.

Messrs. Clarkson and Newman claim that their hypothetical designs have been derived by taking values of the parameters of aircraft now being offered for 1959-1962. I do not know which aircraft they have used, but the two described in Table 1 represent a turbojet which is considerably more efficient than the Boeing 707-420 (which has not yet been built) and a turboprop which is less efficient than the Britannia (which is now in airline service). This does not seem to me to be the way to establish a scientific principle.

My own efforts to establish the relative economics of turbojet and turboprop have been in the form of complete aircraft design studies based upon current best engine performance as quoted by the various manufacturers. I think this is the right way to do the job.

However, since my findings are now challenged, I propose to try to show where my challengers could be wrong.

For the purpose of this argument, let us leave the short ranges out of it and concentrate on the 2,500-mile block distance chosen by Messrs. Clarkson and Newman and over which they show the turbojet to have its greatest advantage.

Let us also forget about "averages" and get right down to brass tacks and use figures for actual aeroplanes which are being offered. In the table is shown the few simple design parameters which are necessary for an operating cost estimate to be made. The aircraft I have chosen to portray are the Boeing 707-420 and the Vickers Vanguard. With these, I have re-stated Messrs. Clarkson and Newman's aircraft and, finally, included a pair of my own design studies.

The direct operating cost method used is my own short-cut method (R.Ae.S. *Journal* for July 1957) and the various parameters for the two existing aircraft have been culled from the pages of aeronautical journals and from the Civil Aircraft Data Sheets published by Aviation Studies, Ltd.

A study of this table produces the following main conclusions:—

(1) My operating cost short-cut method produces the same answer for the two Clarkson and Newman hypothetical designs as does their own full treatment, i.e., a 12 per cent advantage to the turbojet. (This establishes a basis of agreement supporting the validity of my method.)

(2) The Clarkson and Newman hypothetical turbojet is 28 per cent less costly to operate than the Boeing 707-420, whereas their hypothetical turboprop is 18 per cent more costly than the Vickers Vanguard. Surely, therefore, their whole argument falls to the ground since their chosen designs are not representative.

(3) The Vanguard figures produce operating costs 23 per cent lower than those of the Boeing 707-420, and my own predictions for idealized designs show the turboprop to maintain this same advantage.

(4) There are very few differences between the parameters of the Clarkson and Newman turbojet and my own, but our turboprops are widely different. Mine represents a reasonable advance over Vanguard whereas their hypothetical turboprop is nowhere near as good as the Vanguard.

* * *

All my design studies have led me to the firm belief that the turboprop transport is 20 to 30 per cent less expensive to operate than the turbojet (according to the design range), provided that both are designed with the same degree of aerodynamic and structural skill and that they are intended to deal with approximately the same traffic transfer-rate. I do not believe that there is any considerable weight of technical opinion which would deny this.

The point over which there is admittedly still considerable argument is: *"Is the acknowledged advantage of the turboprop in direct operating cost sufficiently large to allow an operator using it to compete with the appeal of the faster and probably smoother turbojet?"*

Personally, I think it is; John Public is more interested in a lower fare than any other single advantage. The trouble is that it needs a lot of courage to fight for fare differentials for the cheaper and slower aircraft.

I am unrepentant in my belief that, if we are not very careful, both the Russians and the Americans will beat us into the air with the *optimum transport*—the big turboprop cruising at 400 kt above the tropopause.

One of the contributory reasons for the cost differential between turboprop and turbojet is the higher first cost of the latter. Messrs. Clarkson and Newman state that there should be no difference, but I disagree. The higher the cruising Mach number the more costly will be the airframe, and this trend is borne out by actual costs.

A study of the prices quoted for current and future transports shows a clear difference in first cost per lb of weight-less-fuel-and-payload of some 14 per cent in favour of the turboprop.

	Turbojets			Turboprops		
	Boeing 707-420	Clarkson & Newman	Robertson	Vickers Vanguard	Clarkson & Newman	Robertson
All-up weight (lb) ...	295,000	191,000	193,000	141,000	170,000	146,500
Weight less fuel and payload (lb)...	128,000	*96,500	94,500	76,500	*92,000	77,400
True mean cruising speed (kt)	474	478	478	352	357	385
Capacity payload (lb) ...	38,000	29,000	29,000	28,000	29,000	29,000
Capacity fuel (lb) ...	153,250	65,500	69,500	40,500	49,000	40,100
Equivalent still-air range (max.) (n.m.)	5,130	3,370	3,370	3,150	3,080	3,080
First cost (£)	1,945,000	1,160,000	1,325,000	800,000	1,130,000	876,000
Block distance (n.m.) ...	2,170	2,170	2,170	2,170	2,170	2,170
Corresponding E.S.A. range (n.m.)	3,370	3,370	3,370	3,080	3,080	3,080
Fuel carried (lb)... ...	100,800	65,500	69,500	39,500	49,000	40,100
Payload carried (lb) ...	38,000	29,000	29,000	25,000	29,000	29,000
Annual utilization (hr)...	2,500	2,500	2,500	2,500	2,500	2,500
Direct operating cost (two-third load factor) (pence/ton-n.m.) ...	23.42	18.81	21.03	17.96	21.15	16.27

* These figures were not quoted by Clarkson and Newman, but are deduced. They could be slightly wrong, but this will not affect the results significantly.

OTHER PEOPLE'S NATIONALS

DAY-BY-DAY REPORTS OF RECENT GLIDING CONTESTS IN FRANCE AND THE U.S.A.

THE first two weeks in July were chosen this year by the respective organizers of both the French national gliding championships at Pont St. Vincent and the 24th annual U.S. national soaring competitions at Elmira. In the former, eighteen chosen pilots competed for the title of national champion, all flying Bréguet 901s, while in addition the international class included three other Frenchmen and representatives from Britain, Belgium, Czechoslovakia and Switzerland. At Elmira, there were 32 entrants.

The tasks, performances and weather conditions at these two meetings make interesting comparisons with those of our own national championships at Lasham, now taking place. Brief details of each day's flying at the French and American contests are given below.

French Nationals at Pont St. Vincent. The eighteen seeded pilots in the French contest included three women, Mlle. Marguerite Dupuy de Mery, Mlle. Francine Abadie and Mme. Marcelle Choisnet-Gohard, and the existing French champion, Jaques Lacheny. The additional French pilots in the international class were Gérard Tahon (Wassmer Javelot), Paul Lepanse (Bréguet 902) and Jean Cayla (Bréguet 904), while Britain was represented by Dr. Brennig James who flew an Air 102.

Sunday, June 30, was the opening day, the official ceremony being performed by M. Fichet of the Service de la Formation Aéronautique et des Sports Aériens. Task for the day was free distance, with first take-off into a light north-easterly wind at 11 a.m. The day's best performance was by Lt. Jean-Paul Weiss (230 miles), whose nearest rival was Mme. Choisnet-Gohard (180 miles). In the international field of 25, James of Britain was ninth and Lacheny 19th.

A race of 97 miles to Troyes was set for the second contest day (Tuesday, July 2). Only five pilots reached the goal, in quite difficult weather conditions, the best time of just over three hours being set up by Daniel Barbera. The four others were Camille Labar, Jules Landi, Mlle. Dupuy de Mery and Lt. Weiss, whose overall lead was now closely followed by Labar, Barbera and Landi.

Thursday, July 4, was the third contest day, and free distance was again the task. With little instability and a strong southerly wind, distances were not notable; Labar flew farthest to reach 68½ miles, with James a close runner-up with 67½ miles, and Lacheny third with 67. After this day's flying Labar lay first with 2,698 points, and James was 7th with 2,068.

Distance along a line from Pont St. Vincent to Sarreguemines (originally a 60-mile race to the latter) was the task for Friday, July 5. Conditions were again difficult, and the maximum distance (53 miles) was logged by James. Second with 47 miles was the Czechoslovak pilot Zejda, flying a Démant, while in third place was Mlle. Dupuy de Mery (36 miles). *"Cette jeune fille de 22 ans,"* the day's official communiqué stated, *"est la révélation de ces Championnats."* James was now runner-up to Labar on total points.

The task on Sunday, July 7, was a 46-mile race to Sarrebourg, which 23 competitors completed. Max Gasnier received the day's 1,000 pts for the best time (1 hr 6 min), while James (7th) was sufficiently ahead of Labar (16th) to take over the lead in the international class with 3,948 pts.

The British pilot retained this lead after the sixth contest day (Monday, July 8) when the task was a 63-mile out-and-return race to Epinal. Zejda of Czechoslovakia completed the course in the shortest time (1 hr 56 min); Weiss was second, Lacheny 9th, James 17th and Labar (who landed half a mile short) 18th. Mlle. Dupuy de Mery damaged her Bréguet on landing and was forced to retire from the contest.

A triangular race of 67 miles with turning points at Void and Neufchateau took place on Tuesday, July 9. A total of 21 pilots completed the course, and again it was Zejda who logged the day's best time (1 hr 42 min). Lacheny was runner-up. On total points to date, Zejda had 5,419, James 5,303 and Weiss 5,229. Labar and Lacheny were 6th and 7th with 5,060 and 4,999.

Eighth and last contest day was Thursday, July 11, when free distance was again specified. This proved to be the best long-distance day of the Championships, with Commandant René Fonteilles achieving 364 miles to Brignoles, where he landed at 10.15 p.m. After him were Zejda (350 miles), Barbera (276 miles) and Lacheny (256 miles). James was unlucky, making only 104 miles and finishing 22nd out of 23 pilots. The daily communiqué commented, *"L'exploit de Fonteilles et de Zejda a donné à cette épreuve un relief extraordinaire."*

The final totals showed the new French national champion to be 27-year-old Lt. Jean-Paul Weiss, of L'Armee de l'Air, with 6,231 pts. Close behind were Barbera (6,117) and Labar (6,114) followed by Lacheny (6,032), Landi (6,002) and Trubert (5,969).

The international class was headed by Zejda of Czechoslovakia (6,383 pts), followed by Barbera (5,843), Weiss (5,788), Labar (5,722), Lacheny (5,703), Landi (5,609) and James of England with 5,588.

On Sunday, July 14, the annual Victor Boin gliding challenge competition was held at Pont St. Vincent. This contest, founded by the president of the Belgian Olympic Committee, is for the greatest distance flown in one flight, and this year there were 23 entrants, of which four were Belgian, one British and the remainder French.

Weiss repeated his success in the Nationals by flying 218 miles and taking first place, with Brennig James of Britain runner-up with 188 miles. Third was Mlle. Dupuy de Mery (180 miles). D'Otreppe, Xhaet, de Kerchove and Mme. de Bauche, all of Belgium, were placed fourth, fifth, sixth and eighth.

U.S. Nationals at Elmira. Sponsored and organized by the Elmira Area Soaring Corporation, and sanctioned by the Soaring Society of America, Inc., the American competitions began on Tuesday, July 2. At a short opening ceremony, representatives of Chemung county and Elmira extended official welcomes to the pilots and crews, after which Miss Joane Clauss, "glider queen," was introduced. For the contestants, an out-and-return race to Warren Eaton airport, Norwich, 76 miles to the north-east, was specified.

The north-westerly crosswinds were stronger than predicted, and no pilot completed the course. Best performance was that of Paul A. Schweizer (Schweizer 1-24) who achieved 113.5 "point miles". Dry thermals were active up to 6,000ft, and many pilots used ridge lift to reach the turning point.

A moderate task was chosen the following day, in keeping with the weather conditions. This was a goal race to Tri-cities airport, 41 miles to the east. Of the 29 contestants, 13 reached the goal, in times ranging from 50 min to 2 hr 24 min. The day's 1,000 pts went to William O. Hoverman (Schweizer 1-23D) who took the overall lead with Lyle Maxey (Prue 215A) second and Bernard Carris (Schweizer 2-25) third.

The next day's flying is best reported by direct quotation from the daily bulletin: "No contest day, as it turned out. It was suspenseful, though, because nobody knew for sure whether two pilots had made a minimum distance of 32 miles. Conditions were poor as more overcast moved in after the task had been set; a 100km triangular speed course having turning points at Waverley and Ithaca . . .

"A few passes were made over the start plane but many of the ships had to come back in for subsequent tries. And then the bumping began. As per the rules those who did not have a score better than one-third of the average of the top three had to give way on the starting line to those above. Some made as many as three tries with most pilots finally deciding to at least make a glide to O'Brien's Restaurant near the first turning point for free steak dinners. . . . Mr. O'Brien had his show and served his steaks to some seven pilots and their crews."

Friday, July 5, was the third contest day. The task finally agreed was a goal race to the airport at Sydney, N.Y., after distance along a line through Sydney had been considered. The weather was superb, however, and "it pained pilots to have to fight their way down at the goal, only 77 miles out." The pilots with the fastest times, who received cash prizes following the designation of the task as the Larry D. Bell Memorial Race, were Graham Thomson (RJ-5), Raymon Parker (PJ-1) and H. P. Bovenkerk (Schweizer 1-23D). Their times were respectively 1 hr 2 min; 1 hr 14 min and 1 hr 18 min. Of the 30 pilots who tried, 21 achieved the goal.

On total points, Maxey was leading with 2,485, followed by Bernard Carris (Schweizer 2-25; 2,444), Francis Compton (L-K; 2,142) and Delbert W. Miller (Schweizer 1-23; 2,096).

Splendid weather on Saturday, July 6, resulted in one of the highest total mileages—4,927—ever logged in one day from the Elmira site. Compton flew 320 miles to Plymouth, Mass., and "amazed everyone by pushing his old yellow L-K all that distance to the ocean". This was the second longest flight ever made from Elmira. Richard E. Schreder in his HP-7 made a goal flight of 306 miles to Logan Airport at Boston, crossing the Boston metropolitan area and bay on his final glide. Stan Smith (Schweizer 1-21) was third, with a 244-mile goal flight to Hiller Airport at Barre, Mass.

(Continued at foot of page 161)

BRITISH NATIONALS AT LASHAM

THE 1957 GLIDING CHAMPIONSHIPS: ENTRANTS, PILOTS AND AIRCRAFT

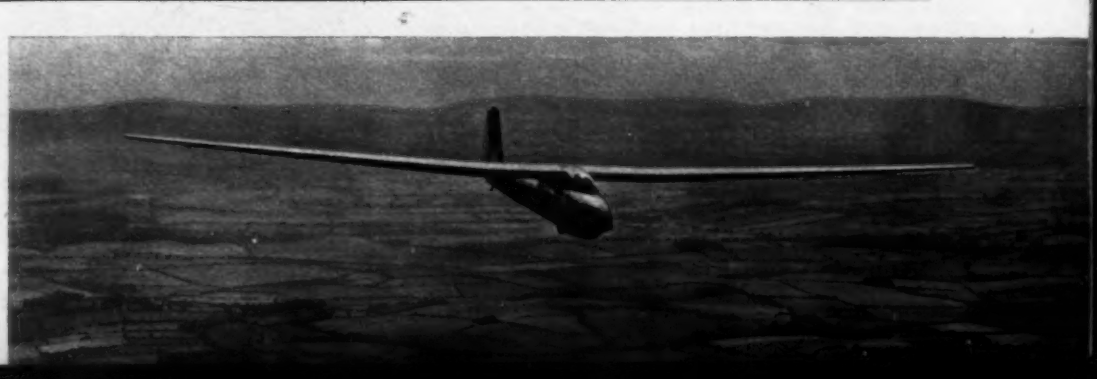
FULL entry lists are given on this page for Britain's biggest-ever National Gliding Championships, the opening days of which are reported overleaf. The league system, explained in our issue of July 19, is new this year, and is designed to cater for two main groups—entries of world-championship standard, and others limited either by pilot experience or by aircraft performance. Particularly significant is the fact that the first five pilots provisionally seeded for the British team for next year's world contest are all flying the same type of sailplane—the Slingsby Skylark 3, one of which is pictured above. In the tables shown, many of the entries are by private-owner syndicates; partners' names are not given. First pilots' names only have been included in the case of two-seaters, for which there is no separate class this year.

ENTRY LIST: LEAGUE 1

No.	Entrant	Pilot	Type
1	P. A. Wills	P. A. Wills	Skylark 3
2	J. H. Hickling	A. Pickup J. H. Hickling	Skylark 2
3	A. Coulson	A. Coulson	Skylark 3
4	W. A. H. Kahn	W. A. H. Kahn	Olympia
5	F. Foster	F. Foster	Skylark 2
6	H. C. N. Goodhart	H. C. N. Goodhart	Skylark 3
8	E. J. Furlong	G. H. Stephenson E. J. Furlong	Skylark 3
9	A. J. Deane-Drummond	A. J. Deane-Drummond	Skylark 3
11	M. V. Laurie	J. C. Neilan L. Welch	Eagle
13	Army G.C.	J. C. Cotton	Skylark 2
15	Imperial College G.C.	W. N. Tonkyn	Skylark 2
16	R.A.F.	A. W. Gough	Skylark 3
20	D. R. Clayton	D. H. G. Ince	Skylark 3
21	Surrey G.C.	J. S. Williamson	Weihe
22	R. Procter	D. B. James	Gull 2
29	R.A.F.	K. C. Fitzroy	Gull 4
40	G. H. Nixon	G. H. Lee R. C. Stafford-Allen	Olympia
42	D. A. Smith	C. A. P. Ellis	Olympia
44	A. H. Warminger	A. H. Warminger	Skylark 3
56	Cambridge U.G.C.	G. S. Neumann P. J. Neilson	Skylark 2
58	Derby and Lancs G.C.	D. M. Kaye F. Breeze	Skylark 2
59	E.T.P.S.	P. L. Bisgood	Sky
64	London G.C.	D. A. Smith	Sky
66	Slingsby Sailplanes, Ltd.	F. G. Irving P. Minton	Skylark 3
68	Surrey G.C.	A. D. Piggott	Eagle
73	H. C. G. Buckingham	G. A. J. Goodhart	Olympia 4
74	J. Tweedy	J. Tweedy B. Thomas	Sky
75	G. A. J. Goodhart	—	—

ENTRY LIST: LEAGUE 2

No.	Entrant	Pilot	Type
7	J. V. Inglesby	J. V. Inglesby	Olympia
10	P. Scott	P. Scott, P. Collier	Eagle
12	Army G.C.	N. J. Dickson, R. C. H. Barber, E. Stark	Skylark 2
14	Bristol G.C.	A. O. Sutcliffe, J. M. Hahn, T. R. H. Parkes	Olympia
17	Shorts G.C.	S. Morison	Nimbus
18	G. Benson	G. Benson, C. Green, J. Knotts	Skylark 2
23	Crown Agents G.C.	Mrs. R. Harwood	Olympia
24	R.A.F.	J. L. Bayley	Kranich
25	R.A.F.	G. J. C. Paul	T.21B
26	R.A.F.	D. H. Ellis	Olympia
27	R.A.F.	M. Jobling	Olympia
28	R.A.F.	N. W. Kearon	Olympia
30	R.A.F.	F. Allen	Gull 1
31	R.A.F.	C. S. Scorer	Grunau 2b
32	H. A. Pitt-Roche	H. A. Pitt-Roche	Sky
33	R. H. Perrott	J. N. Cochrane, B.J. Palfreeman	Skylark 2
34	R. G. F. Fowler	R. D. Dickson, H. Corney	Gull 4
35	E. A. Moore	G. W. Mackworth-Young, E. A. Moore	Skylark 2
36	P. Hampton	P. Hampton, D. Scallon	Skylark 2
37	B. Thomas	J. B. Jefferson, A. H. Baynes, K. W. Bleke	Skylark 2
38	J. D. Jones	J. D. Jones, M. J. Hodgson	Olympia
39	Polish A.F.A.G.C.	B. E. Lastowski	Olympia
41	P. A. MacNaughton	R. Rutherford	Skylark 2
43	J. E. Torode	J. E. Torode, G. Burton, D. Martlew	Petrel
45	J. C. Riddell	J. C. Riddell	Skylark 1
46	E. Day	E. Day	Sky
51	A.T.C./R.A.F.	R. C. Jones, W. Verling	T.21B
52	A.T.C./R.A.F.	J. Oliver, C. F. Hunt, S. Naylor, J. J. Mawson	T.21B
53	A.T.C./R.A.F.	P. Hart, J. Ladley, P. G. Binder, K. R. Pearson	T.21B
54	A.T.C./R.A.F.	F. R. E. Hayter, J. C. Allan, McK. Lowe, J. C. Farrell	T.21B
55	Cambridge U.G.C.	J. H. E. Edwards, A. A. McDougall	T.21B
57	Cambridge U.G.C.	G. R. Whitfield, M. I. Gee, M. C. Jackson	Olympia
60	E.T.P.S.	R. J. Cockburn	Olympia
61	London G.C.	M. P. Garrod, C. W. Bentson	Olympia
62	London G.C.	J. M. Hands, S. R. Dodd	Skylark 2
63	London G.C.	J. C. Everitt	T.21B
65	R.N.G.S.A., Dartmouth	R. Brett-Knowles, E.J. Robinson	Kranich
67	Southdown G.C.	J. H. Holder, D. Snodgrass	Olympia
69	Surrey G.C.	J. K. Mackenzie	Olympia
70	Surrey G.C.	B. Sinclair, G. R. Paddick	Olympia
71	Surrey G.C.	H. Hilditch, J. Simpson, D. Kerridge	Olympia
72	N. Anson	N. Anson	Olympia
77	R. A. Young	R. A. Young	Schweizer 1-26A



Among the Lasham competitors are Nick Goodhart's Skylark 3, seen (above) displaying its 20.5 aspect ratio, and the T.42B Eagle (right) flown by John Neilan and Lorne Welch.

"Flight" photographs

LASHAM'S ROYAL OPENING

THE NATIONAL GLIDING CHAMPIONSHIPS

From KENNETH OWEN, Lasham Airfield, July 29.

THE 1957 National Gliding Championships just *had* to be good. They were being held in a vintage year for gliding weather—a year in which "Gold C" heights and distances had become almost routine news. They involved no fewer than 70 aircraft. And they were to be opened by the Duke of Edinburgh.

This meant that the contest had a lot to live up to, right from the start. And the start, made last week-end, proved a slow one. This was probably just as well, for the organization of any meeting on such a scale is no simple task.

Many competitors were already installed at Lasham by the opening Saturday, July 27, including the large and efficiently organized R.A.F. contingent, whose massive encampment had taken shape over a week before. Their practice week had not been particularly fruitful in long-distance cross-countries—the weather had not been co-operative—but, well-established, they now looked forward to championship-type weather in the coming week.

On the Saturday, the trailer parks filled up as the latecomers arrived. The biggest question in the entry list—whether Elliotts' Olympia 403 would be completed and ready to fly in time—was answered. In spite of the fears of many, the answer was yes, and so Tony Goodhart did not need his extra "insurance" entry, No. 75.

From Belfast, a beaming Stuart Morison arrived, proclaiming the merits of the Short Nimbus two-seater, reappearing in public after an absence of several years. It had a performance superior to an Olympia's he said. No, the machine had not yet made its first cross-country flight.

Recently returned from Aden, A. Cdre. G. J. C. Paul, ex-chairman of the R.A.F.G.S.A., was to fly a Slingsby T.21B this year in League 2 of the championships. Still more recently returned from France, where he had put up a good performance in the French Nationals, was Dr. Brennig James, who was to fly the all-yellow Gull II two-seater. A complete newcomer to British competitions was Ray Young, an American airline captain, and his kit-built Schweizer 1-26A *Golden Flyer*.

Saturday afternoon's weather was damp and blustery, with a strong westerly wind and low cloudbase. In spite of this, the planned air display (with the assistance of the Tiger Club) and glider aerobatic competition were held. Practice aero-towed flights were made by several pilots, although virtually no soaring was possible. In the evening a general briefing meeting was held.

In the workshop area behind the flight hangar an impressive piece of ground equipment had provoked much interest. Made by Storhaven Engineering of Newhaven, this was a 100 h.p. diesel-electric four-drum winch on which trials have recently been completed at Lasham. A launching rate of four gliders in twelve minutes and a daily fuel cost of only ten shillings are claimed for the machine, which is expected to sell for £2,750.

Sunday's weather showed little change from that of the previous day, and a fine drizzle was falling as the 70 sailplanes and over a dozen tugs were lined up on the grass and at the launching point prior to the arrival of the Duke of Edinburgh. At a short pre-briefing meeting of competitors, it was announced that a non-competition task would be set for League 2 pilots; if the weather showed any improvement, an afternoon task might be set for League 1.

Prince Philip straps in. Centre, John Neilan; right, Lorne Welch.

A Naval S-55 touched down precisely at 10 a.m., and Prince Philip climbed down from the right-hand pilot's seat to be met by Philip Wills, chairman of the British Gliding Association, and Hugo Trotter, chairman of the Surrey Gliding Club. In a short speech of welcome, Mr. Wills contrasted the low standard of living evident to visitors to Lasham with the high standards which governed everything connected with the sailplanes themselves. The aircraft, he said, came first. He hoped the Duke would like what he saw, and would approve of "what we do and how we do it."

Replying, Prince Philip (who was wearing the new B.G.A. tie) commented that he did not think speeches and gliding went together very well. He went on to mention the gliding movement's self-discipline and control, which had made external controls unnecessary. This, he concluded, showed (a) that gliding people were sensible and responsible and (b) that, if more people were sensible and responsible, we would not need so much government.

Beginning the pilots' briefing, Ann Welch, clerk of the course, revealed that the task for League 2 aircraft was to be a goal race to Hamble. First take-off would be at noon, just after Prince Philip's flight in the world-champion Eagle, while the League 1 task, if any, would be announced at a further briefing at 2.30. Performance in the race to Hamble was not to count towards championship points, as the weather was not really good enough for contest flying.

This last remark was amplified by C. E. ("Wally") Wallington, who next gave the day's met. briefing. Cloudy conditions with intermittent rain would continue, he said, with only small breaks in which there might be weak thermals. Cloudbase was averaging 2,000ft, and "a good working wind" for the pilots was 340/25 kt. Last speaker at the briefing was P. C. ("Bunny") Austin, chief marshal, who gave details of the operating procedures. As during the practice day, take-offs would be along the main runway to the west, in spite of today's strongish crosswind.

There can scarcely ever have been a more colourful and impressive sight than the 70 graceful and many-toned sailplanes which the Duke next inspected. With the exception of the white-overalled R.A.F. crews, the competitors themselves were also displaying the colourful informal garb associated with gliding people everywhere.

General scene on the airfield as the Eagle, flown by the Duke of Edinburgh and Derek Piggott, makes its final approach to land. The aircraft, entry No. 11 in the championships, is the property of a syndicate at Lasham.

"Flight" photographs

Above, Mrs. Rika Harwood, the only woman entrant, and Sgt. Andy Gough of the R.A.F. Right, the competing aircraft include No. 22, the Gull II; No. 18, Skylark 2; and No. 59, the E.T.P.S. Sky (seen near three Chipmunk tugs).

After speaking with pilots and crews, and displaying a keen interest in the various types of sailplane, Prince Philip took his seat—the front seat—in entry No. 11, the T.42B Eagle which had gained the world two-seater championship at St. Yan. Back-seat driver on this occasion was Derek Piggott, C.F.I. of the Lasham Gliding Centre.

Experienced observers at the launching point, familiar with Derek Piggott's flying, commented that the Eagle's take-off gave the impression of a glider pilot making his first aero-tow—which was true enough. Tiger G-AOXS, flown by chief tug pilot David Darbishire, had been selected for the important visitor's flight. This was the Duke's second glider flight, the first having been made with Peter Collier in an Eagle from Nympsfield last May.

The Duke's flight lasted about 20 minutes, after which the stream-launching system of aero-tows swung into life for the first time at this meeting. Competitors selected their times of take-off at 1½ min intervals, and the tug Tigers, Chipmunks and Gemini delivered them to the specified altitude. Little lift of any kind was experienced, however, and most were forced soon to return to the airfield—providing an excellent spectacle for the sizeable public crowd which was present.

Meanwhile, the Duke of Edinburgh was visiting the workshop and the hangar, where he was interested to see two members of the British Parachute Club, who had earlier made display descents, re-packing their parachutes. Outside the hangar a Skylark was de-rigged for the Duke, who later joined Lord Brabazon, Mr. Airey Neave, B.G.A. officials and club chairmen for cocktails and lunch.

Later that afternoon, after a steady stream of launches—punctuated by the gap in flying appropriate to a Purple Airway, indicating Prince Philip's departure—conditions improved slightly. Several aircraft could be seen circling at heights up to 6,000ft a few miles south-east of the field. No League 1 task had been set. In spite of the improvement, however, it just was not a going-away day—as two loudspeaker announcements made clear.

The first told us that S/L. Scorer in the Grunau from the R.A.F.G.S.A. Four Counties Club, Wittering, had landed six miles south of Alton. Most people present were able to recall that Alton was but three miles or so from Lasham. A later announcement concerned the genial Ben Lastowski in the Polish club's Olympia, who had come down 3½ miles east of Bentley. Bentley, we remembered, was not very much farther away than Alton.

At the end of the day there were nine landing reports pinned to the wall of the Press office. The longest distance was only 17½ miles, achieved by John Williamson in the Surrey club Weihe in a flight to Shirrell Heath, near Eastleigh. It had not been a contest day, but Sunday's flying had provided excellent practice for the organizers, competitors and helpers alike. As the Monday briefing was to show, there were many snags to overcome in a contest of this size, but these were not insuperable.

Goal races for both leagues were set on Monday, July 29. For League 1 pilots it was a 95-mile flight to Hawkinge; for League 2, 56 miles to the South Down Club's site at Firle. Seven League 2 pilots reached Firle, Brian Jefferson (Skylark 2) achieving the fastest time of 1 hr 34 min. In League 1, nobody managed to fly as far as Hawkinge; longest distance was 69 miles, by Philip Wills in his Skylark 3.

(To be continued)

Lt-Col. Tony Deane-Drummond, pilot of a Skylark 3.
"Flight" photograph

OTHER PEOPLE'S NATIONALS

(continued from page 158)

Among the "remarks" in the day's score-sheet were, for Andrew Smith (LO-150) "Landed at Marjorie's Kalorie Korner, Falls Village, Conn."; and, for John Bierens (T-3) "Crew lost car key just after take-off".

News of the death of Paul Schweizer's father, a great friend of American soaring, was announced at this morning's meeting of pilots.

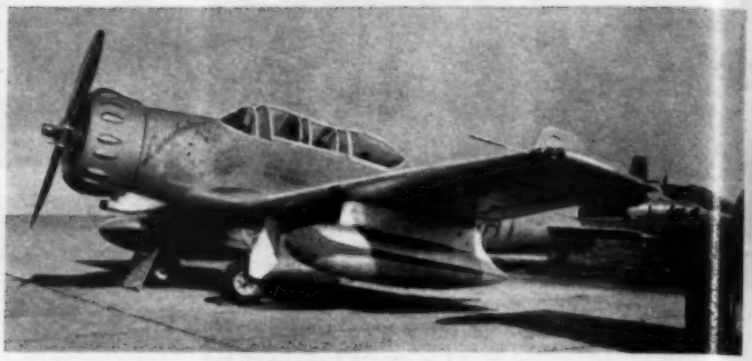
After a rest day on Sunday, the Monday task was declared to be a goal race to Hancock Field, Syracuse, N.Y., some 78 miles to the north-east. A wave system enabled Stan Smith to complete this course, but the later weather was so dead that Miller (41 miles) was the only other pilot to exceed 20 miles. This brought Smith into first place with 3,697 pts, followed by Maxey (3,199), Compton (3,168), Miller (3,016) and Carris (3,008).

Tuesday, July 9, featured a 200km (125-mile) triangular race with turning points at Endicott and Cortland, N.Y.—a course that none of the contestants was able to complete. Tailwinds and good cumulus were experienced on the first leg, but the second-leg lift was too weak for much progress to be made against a quartering headwind. Eight pilots landed at the first turning point and 18 more struggled on along the second leg. Compton (73 miles), Bikle (73 miles) and Lincoln (70 miles) made the best distances, all in sight of Cortland.

The overall top placings were now Smith, 4,423; Compton, 4,168; Maxey, 4,076; Carris, 3,857; and Bikle, 3,736. A free pancake supper and square-dance "to help shake down the stomach loads" were laid on that evening.

At the start of flying on the last contest day (Wednesday, July 10) each of the top six pilots had the chance of winning the championship. It was an "open day" with no set task.

The day's farthest flight was 244 miles by Paul Bikle to the southernmost tip of New Jersey, where he landed on the beach. Stan Smith and Richard Schreder each made 230 miles to Atlantic City, N.J., and Robert Smith (L-K) achieved 229 miles to Woodbine, N.J. This confirmed Stan Smith as the new U.S. national champion. He had gained 5,366 pts, followed by Bikle (4,736), Compton (4,570), Schreder (4,375), Thomson (4,315), Richard Smith (4,259), Carris (4,193) and Maxey (4,076). The last-named pilot had not flown that day, having withdrawn to arrange for repairs to the borrowed Prue 215A which he had damaged on Tuesday. The final evening was devoted to a tour of the Pleasant Valley Wineries at Hammondsport.



(Left) The float-equipped Kolibrie helicopter referred to on this page. (Above) A Fiat G-49 with Vampire 100-gal wing tanks, which is to tour North and South America this summer.

AIRCRAFT INTELLIGENCE

U.S.A.

Convair B-58. Fifty different versions of pods for the B-58 Hustler supersonic bomber (reports *Aviation Week*) have been studied thus far. The possibility is mentioned of a powerplant being carried in a pod to increase speed—already in the vicinity of Mach 2. The power unit could be a turbojet, ramjet or rocket. When range is a primary factor the pod could carry fuel. In the present configuration both fuel and bomb space are provided. Electronic counter-measures or cameras are other possible contents.

Douglas A4D-2 Skyhawk. Although weighing only 8,300 lb empty and having a nominal gross weight of about 15,500 lb, the Skyhawk attack bomber has already been flown at a gross weight of more than 22,000 lb.

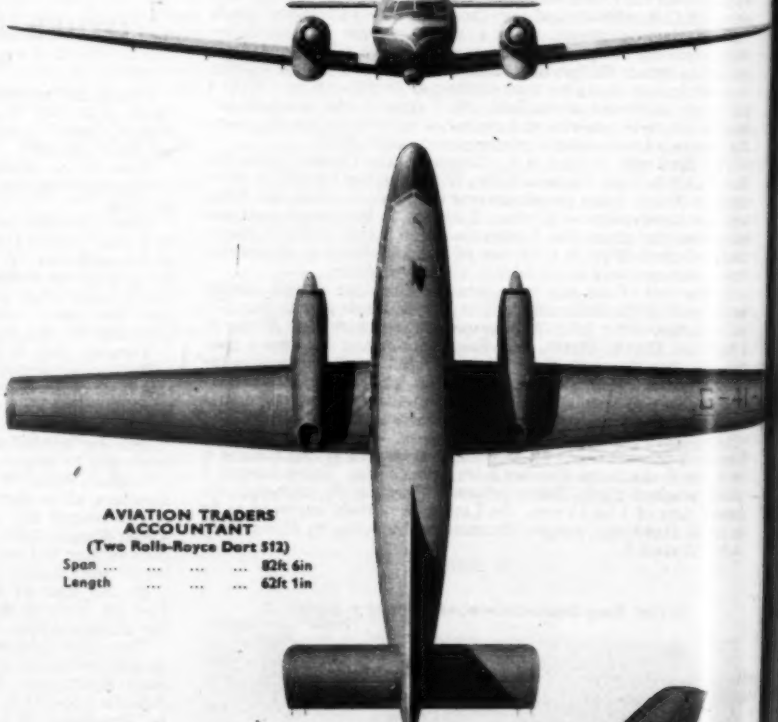
France

Dassault Super Mystère IVB.2. Our German contemporary, *Flug-Revue*, has published a report by German test pilot Wolfgang Späte on a flight in the third prototype Mystère IVB.2 at Melun. Späte gave very few details of performance except that he climbed to 42,700ft to start his evaluation, found no transonic disturbances whatever, but failed to obtain an indication above Mach 1 on the level at a height of 27,300ft, with 1,320 lb of fuel remaining. He was told to try again between 38,000ft and 42,500ft, and after zooming to the last-named height he reached nearly Mach 1.3 with ease. At this speed he said the aircraft felt "like a tourer at 135 m.p.h."

Max Holste Broussard. The first three Broussards for the French Navy should now have been delivered. Of a total of 316 already on order for various customers, 60 have been accepted to date, of which 45 are for the French Army. The first three of six for Aerotec have been accepted and will be used for civil transport in Algeria. Two others, for Air Gabon, will be delivered this month. The ten ordered by Argentina have already been shipped and a new order from that country is expected.

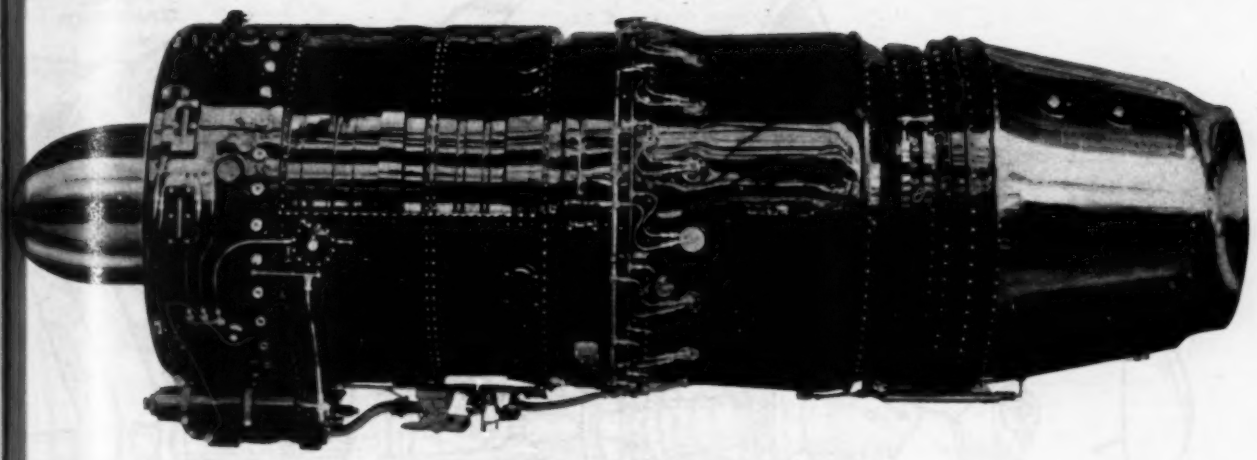
Netherlands

N.H.I. Kolibrie Helicopter. A picture on this page shows the Kolibrie ramjet-powered helicopter with two multi-chamber rubber floats, developed by the N.H.I. engineering team and manufactured by R.F.D.-Holland, Ltd., at Katwijk. Test pilot R. J. van der Harten said, "On floats the craft's as stable as a battleship." The Kolibrie achieved notable success at the International Agricultural Exhibition at Utrecht. Fitted with 49ft spray booms, it was shown mounted on a special trailer for road transport which also serves as a platform for take-off and alighting. Four Kolibries have been ordered by the Central Agricultural Bureau and by the Directorate Wieringermeer. The Kolibrie is claimed to lift more than twice its own weight and to offer twin-engine dependability.



AVIATION TRADERS ACCOUNTANT
(Two Rolls-Royce Dart 512)

Span	...	...	...	82ft 6in
Length	...	...	...	62ft 1in



GYRON

de Havilland's Supersonic Turbojet, with 25,000 lb. Reheat Rating

ALTHOUGH four years have passed since it was announced that the de Havilland Engine Company had in existence a truly supersonic turbojet, until very recently only conjectural analysis of the Gyron's design features could be made. The following full description and cut-away drawing emphasize the simplicity of this very powerful engine and record some of the solutions that have been adopted—as a result of over four years of rig and flight development—to the problems of developing a supersonic gas turbine.

The decision from which the Gyron engine stemmed was arrived at seven years ago, when the company made a detailed consideration of the powerplant to succeed the Goblin and Ghost centrifugal-compressor engines. At this time they initiated a painstaking and comprehensive programme of exploration into the performance characteristics of supersonic turbojets, the aerodynamic and thermodynamic considerations governing the design of such an engine, and the related aspects of the powerplant as a combustion system. Not the least of the problems to be faced at this stage, and quite apart from those of design and manufacture, were associated with component development and with ground and flight testing.

A year later, the further decision to proceed with the design of a high-thrust turbojet for use at Mach 2-3 on a company-financed basis was taken under the direction of the late Major Frank Halford, who was then chairman and technical director of the Engine Company. As no corresponding decision had then been made within either the Government or the industry to proceed with an associated design of aircraft, this was a bold and far-sighted step to take, deeply involving the company's financial resources. It meant that de Havilland engineers were designing for powerplant requirements of a period of, probably, five to fifteen years ahead, and maximum use was made of the comprehensive theoretical investigations already undertaken.

It had been determined that, because of the high flight-speeds concerned, the intake system assumed a greatly enhanced importance. The air approaching the intake exhibited a high level of kinetic energy suitable for conversion to pressure energy by the intake; and the magnitude of the ram pressure available at the intake face of the engine was such that if the optimum pressure-ratio in the engine cycle was to be utilized it was only necessary for the compressor to achieve a moderate pressure ratio. In these circumstances (i.e., where the major proportion of the overall pressure-rise in the engine cycle could be obtained in the aircraft intake) it was obvious that this component should be designed to perform its duty of diffusing the incoming air with the maximum efficiency.

Likewise it had been determined that if very high flight speeds were to be attained a much higher efflux velocity—and hence higher thrust output—was essential. This could be achieved without unduly diminishing the propulsive efficiency of the aircraft. In addition the improvement in engine specific thrust (i.e., lb thrust/lb air mass flow/sec) and fuel consumption could be achieved by increasing the turbine inlet temperature.

The radically higher overall pressure ratio of a supersonic engine implies a similarly increased expansion ratio across the exhaust system. As this latter ratio is virtually constant, the expansion ratio across the propelling nozzle rises with increase in flight speeds; and if this available expansion ratio is to be used to its maximum efficiency a convergent-divergent nozzle capable of achieving supersonic expansion of the exhaust gases is necessary.

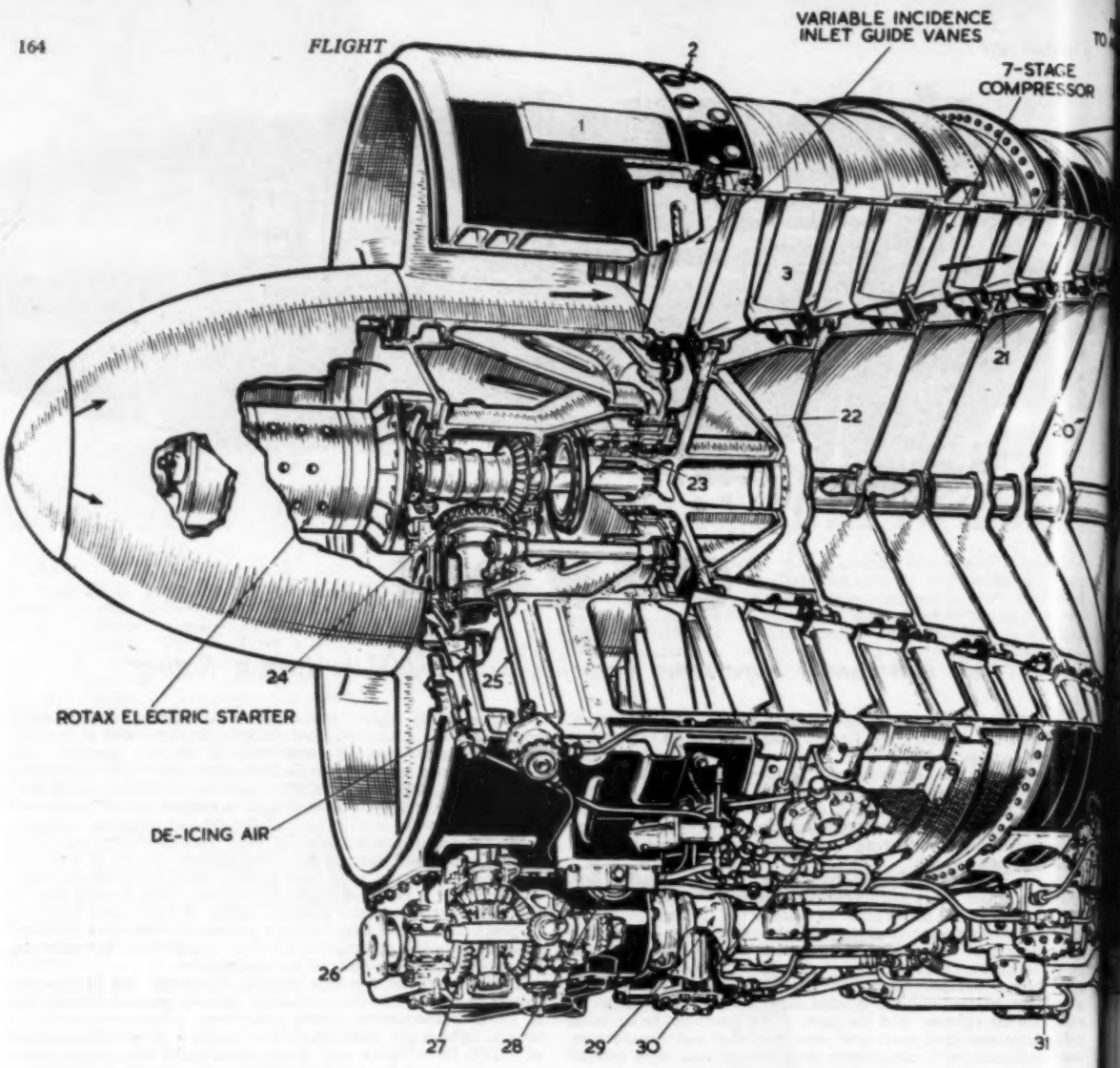
To assess the precise trend of these various effects, curves of specific thrust and specific fuel consumption, plotted in terms of compressor pressure ratio and turbine entry temperature, were produced for a range of flight conditions. They showed that in the consideration of the highest turbine temperatures likely to be practicable in the near future, a particular compressor pressure ratio (a reasonable assumption is 5 or 6 : 1) represents the optimum for supersonic propulsion in the stratosphere.

Design work on the new engine, designated the H.4 as the fourth of the de Havilland/Halford turbine engines, started late in 1951. Subsequently named the Gyron, it was conceived as a simple, lightweight single-shaft unit having a design thrust rating of 15,000 lb—a figure very much in excess of that of any other engine known to be under consideration at the time. The basic layout involved a seven-stage axial compressor and a two-stage turbine united by a large-diameter shaft, the complete rotative assembly being carried on two main bearings only. The combustion system was of fully annular design and employed upstream fuel injection.

Simultaneously with the manufacture of parts for the prototype engine, additional main components were produced for individual testing on rigs. In particular, a rig compressor was built for testing at C. A. Parsons, Ltd., some months before the initial run of the engine, and an open-type test-bed formerly used for bench testing of the Ghost was specially converted to provide for the considerably greater dimensions and thrust of the Gyron.

It was on this bed that the Gyron DGy.1 first ran on January 5, 1953. Apart from minor adjustments which it was found necessary to make to the setting of the inlet guide vanes, design performance was quickly achieved; very high thrust figures were in fact attained by the Gyron within a few weeks of the initiation of testing. And in April of the same year, after the capabilities of the engine had been physically established, it was awarded a development contract and official financial backing by the Ministry of Supply.

During the first year of its development a Gyron with modified turbine blading, combustion and fuel systems completed a 25-hour special-category test at 13,000 lb in May, and by October more than 150 engine hours had been accumulated, with several hours performed at design thrust. In July 1954, a 25-hour run was undertaken at 15,300 lb and this was followed by further runs in which the engine maximum temperature and r.p.m. were progressively increased. In this manner a thrust of 16,500 lb was initially achieved, to be followed by over 100 hours' running at 17,800 lb thrust. Then in September, in view of the continued satisfactory state of the engine, several runs were undertaken at



GYRON...

DE HAVILLAND GYRON DGy.1 AND DGy.2

Dimensions: height, 55.2in; width, 49.9in; length of basic engine, 121.3in; length of engine with exhaust cone assembly and propelling nozzle, 155.5in.

Weight: 4,270 lb (dry).

Performance: DGy.1. Maximum sea level static thrust, 15,000 lb; corresponding specific fuel consumption, 0.95 lb./hr/lb.

DGy.2. Maximum sea level static thrust, 20,000lb; corresponding specific fuel consumption, 1.04 lb./hr/lb.

20,000 lb thrust. This performance, at what was designated the DGy.2 rating, placed the Gyron considerably ahead of any of its competitors either here or abroad.

Development testing of Gyrons for the forthcoming flight-test programme was initiated in August 1954. This led quickly to the successful completion of a 25-hour special-category flight-approval test at 15,200 lb in January 1955. In April that year a flight Gyron was delivered to Short Bros. and Harland, Ltd., at Belfast, where this company was specially modifying one of its Short Sperrin four-engined bombers as a flying test-bed. In July the Gyron took the air for the first time in the lower port nacelle of the Sperrin. Shortly afterwards the aircraft was flown to Hatfield and intensive flight testing of the Gyron was begun.

At the end of the year the aircraft was returned to Belfast for installation of a Gyron in the lower starboard nacelle (with the two Gyrons, control problems at altitudes in the region of 50,000 feet are shortly to be explored.) By April last year the Gyron had completed a flight approval test at 18,000 lb thrust.

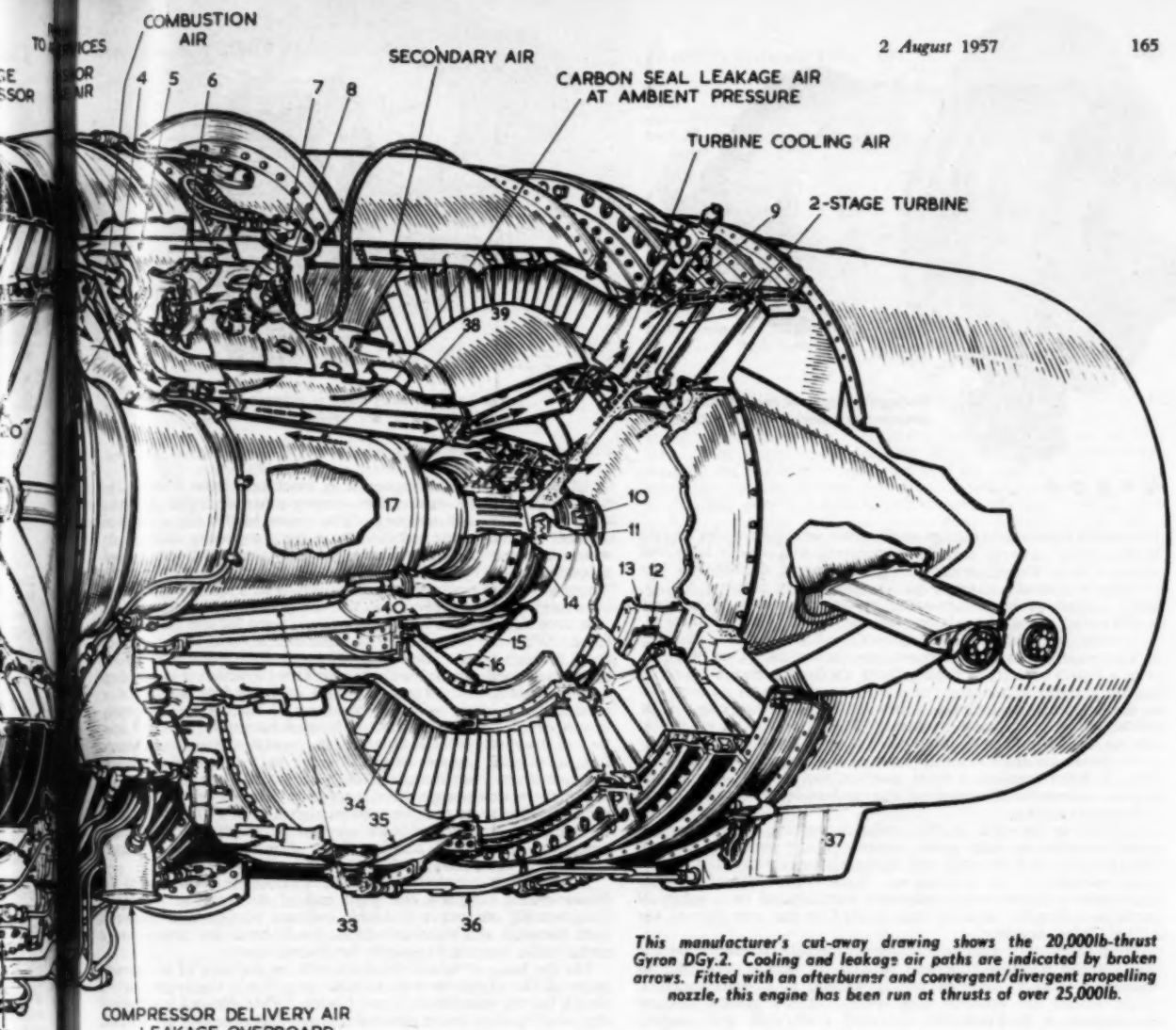
During this period, bench testing of the engine had proceeded apace, and, following a type-test rehearsal run in July 1955, an officially observed 150-hour type-test schedule was successfully completed at the DGy.1 thrust rating of 15,000 lb in August. The manufacturers could claim that this was the highest official rating of any turbojet in the western world. More development runs were made to test modifications to the combustion system and turbine-blade design, and certain changes and additions to the compressor configuration were investigated, bringing a notable increase in thrust.

This work was greatly assisted by the commissioning during 1954 of a new test-bed of massive proportions, specially designed to meet the requirements of accurate and detailed testing of the Gyron. This facility, known at Hatfield as No. 25 bed, is fully silenced and enables testing to be performed during 24 hours of the day—a very valuable asset when undertaking a 150-hour type-test run.

A further important step in the development of the Gyron occurred in January 1955, when a 15,000 lb engine was boosted to 20,000 lb by the addition of an afterburner. This important adjunct to the Gyron has since been tested with a fully variable convergent/divergent propelling nozzle, and the maximum thrust has been steadily raised in the Gyron DGy.2 to over 25,000 lb. Two designs of afterburner have been developed—a short installation and a more lengthy unit for a specific aircraft application.

Mechanical Design. In spite of its greatly increased power, the Gyron follows de Havilland philosophy—established with the Ghost and Goblin—of obtaining reliability through simplicity of design.

Mechanically the engine comprises a direct-entry annular air intake; a compressor of constant outside diameter, utilizing combined drum-and-disc rotor construction; a large-diameter shaft



This manufacturer's cut-away drawing shows the 20,000lb-thrust Gyron DGy.2. Cooling and leakage air paths are indicated by broken arrows. Fitted with an afterburner and convergent/divergent propelling nozzle, this engine has been run at thrusts of over 25,000lb.

1 Intake casing core plate
2 Casting plugs
3 First-stage stator blades
4 Front annular snout
5 Rear annular snout
6 Swirler
7 Lucas Duplex 3 upstream injector
8 High-energy igniter plug
9 Tension spoke attachment
10 Ring nut
11 Hirth coupling
12 Labyrinth seal
13 Inter-stage drum
14 Piston-ring seal
15 Strap
16 Baffle assembly
17 Forged mainshaft
18 Ducted midway swirler
19 Carbon labyrinth seal
20 Compressor rotor discs
21 Hollow pin blade-attachment
22 Supporting cone for first-stage disc
23 Front main bearing assembly
24 Accessory drive bevel gears
25 I.G.V. push/pull rod
26 Power take-off
27 Accessory drive gearing
28 Roller for sliding installation
29 Twin Lucas fuel pumps
30 I.G.V. controller
31 Throttle valve and Lucas air/fuel ratio control
32 Fuel flow distributor
33 Rear bearing oil scavenge pipe
34 Discharge duct (inner)
35 Discharge duct (outer)
36 Wet-start fuel drain system
37 Fuel collector

uniting the compressor and turbine; a forward entry duct to the annular combustion system extended rearward internally to carry the bearing on which the turbine is overhung; and a system of spokes within the first stage nozzle blades to provide radial support of the rear bearing. The engine pick-up points are situated on the intake casing and front turbine shroud ring.

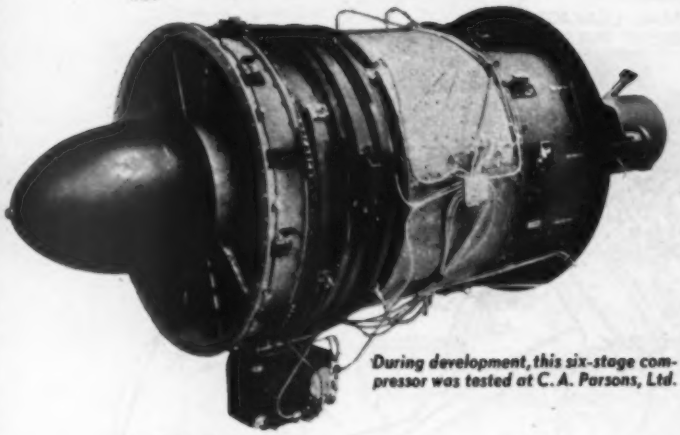
The use of a moderate pressure-ratio (and hence a small number of compressor stages) and the design of the annular combustion system help to reduce the length of the engine and enable a very light two-bearing layout to be used. The necessarily rigid compressor rotor and main shaft configuration is achieved by employing thin steel diaphragm discs to carry the compressor rotor blades and drums to join adjacent discs. Centrifugal loading of the rotor blades is used to increase the axial stiffness of the discs.

The compressor rotor assembly is attached at its rear face to the mainshaft. This latter component is a thin-walled trumpet tapering to a stub shaft at the rear end, where it carries the two turbine discs. A particularly rigid rotative assembly is achieved by tapering-off the maximum diameter at the centre towards the front and rear bearings.

Gyroscopic loads induced at the two main bearings are transmitted to the airframes *via* the engine structure and mounting points. The front bearing loads are carried *via* the intake casing radial support struts and the rear bearing—located axially in line with the first-stage nozzle-blade row—is supported within the inner shroud ring by a series of conical diaphragms. Bearing loads are transmitted to the outer shroud ring by means of narrow-section radial struts passing within each of the hollow nozzle blades, through which cooling air flow is also passed. During assembly the struts are pre-tensioned on a principle similar to that of the wire-spoked wheel.

Carrying the engine internal loads between the front and rear mounting points are the compressor casing and forward entry duct. To provide a rear support point capable of accommodating the axial and radial thermal expansion of the engine, a vee linkage is carried off the nozzle shroud ring on self-aligning bearings. The apex of the linkage (a similar bearing) is picked up by the airframe structure.

Main Engine Components. Considering these in turn, the air intake is a double-walled annular casting (in ZRE-1 magnesium-zirconium alloy) carrying the centre housing for the front main bearing *via* seven streamlined radial struts. A single-wall casing



During development, this six-stage compressor was tested at C. A. Parsons, Ltd.

The forward entry duct is extended rearwards to carry the main rear bearing.

GYRON . . .

of suitably lightweight design might have deformed under engine loads during extreme aircraft manœuvres, and a very light but strong casing was therefore designed, using a double-wall box section—a splendid example of foundry art by Sterling Metals, Ltd. Coring problems are eased by welding plates over access cavities after the sand has been removed and the casting cleaned.

Effective use of the cavity between the walls is made by dividing it transversely into three separate compartments. One of these, with a liquid capacity of three gallons, carries the engine lubricating oil and the remaining two duct hot compressor-delivery air to the compressor inlet guide vanes and to the leading edge of the intake struts for de-icing purposes. The latter flow of air is also ducted through to the double-walled nose bullet.

An extension shaft from the front of the compressor rotor provides a drive through a bevel gearbox and a quill shaft to the engine accessories mounted on the underside of the intake and compressor casing.

Carried in the rear of the intake casing are the compressor variable-incidence inlet guide vanes. These vanes, which are solid forgings in S.96 steel, will ultimately be fabricated as hollow units in order to pass de-icing air. Each is provided at its inner ends with a short swivel extension arm located in a spherical bush in a circular actuator ring carried in the rear face of the intake centre housing.

In the automatic control mechanism initially developed for the I.G.V.s the actuator ring was rotated by means of a pair of hydraulic jacks rather inaccessibly located at a near-tangential angle within the actuator ring itself. In the present control mechanism a hydraulically operated push/pull rod passing through one of the lower intake struts is provided with a crank to rotate a small quadrant geared to the actuator ring. Movement of the rod, and consequent change in vane incidence, is automatically determined by the I.G.V. fuel-pressure-controlled hydraulic system, which in turn is responsive to a selected engine operating parameter.

Attached to the rear of the intake casing is the longitudinally and transversely split compressor casing. The front pair of castings are machined from castings in R.R.58 aluminium alloy; and the rear pair, where the compressor air temperature rise is comparatively high, are machined from castings in Samuel Fox Fortiweld high-tensile welding steel.

All blading in the compressor is machined from forgings in S.62 stainless steel, chosen for—among other desirable qualities—its good vibration-damping. The stator blades are carried in dovetail grooves machined directly in the compressor casing. At their inner end the stator blades are fully shrouded, the related shroud-rings carrying brass labyrinth seals on their inner faces. These are individually machined to run with a specified (but not over-fine) clearance relative to the compressor rotor drum.

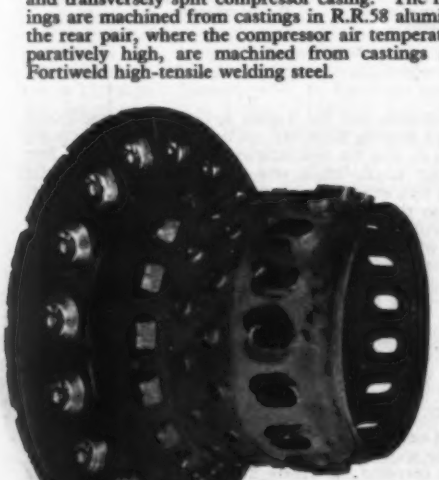
A very simple form of construction is used for the compressor rotor. With the exception of the first and seventh stages each of the S.97 high-tensile alloy steel thin-wall discs has a thin-walled drum machined integral with its rear face by which it is attached to the adjacent disc. Integrally with its front face the first disc carries a stub shaft on which the front of the rotative assembly is supported. A similar shaft is formed integrally with the rear face of the disc. This is bolted to the centre of the second-stage disc, additional support being provided by a thin-wall cone. A separate drum joins the peripheries of the first two discs.

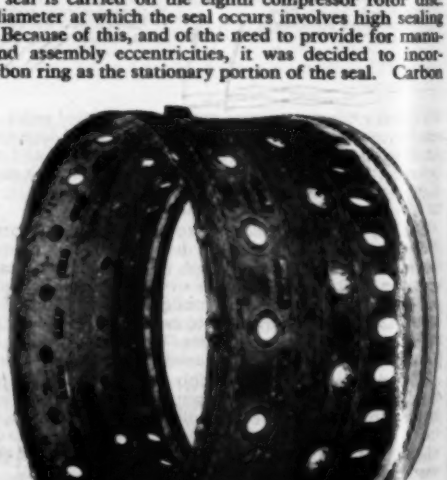
For the seventh-stage rotor, a separate drum is provided which joins the disc at its periphery to an eighth disc. This latter disc, carrying the compressor-rotor air seal, is attached to the front periphery of the main turbine shaft. Aluminium spacer sleeves are fitted at the centre to obviate lateral vibration.

A large triple-race bearing carried in a housing in the rear of the intake casing supports the front end of the rotative assembly. The bearing comprises a double ballrace (designed to transmit both forward and rearward thrust loads from the rotor) and a single roller bearing to absorb the journal loads.

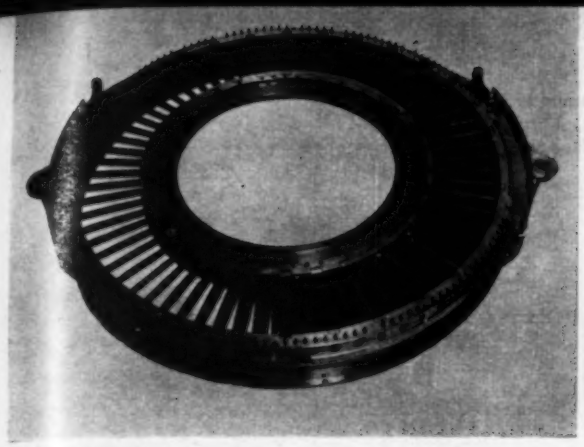
On the basis of information available at the time of the design stage of the Gyron it was decided to utilize a single-pin swivel fitting for the compressor rotor blades. This allows for a limited degree of tip rock in the plane of rotation and so assists in damping out critical modes of vibration. Each blade has a pair of tangs machined integrally with its root, and these straddle the rim of the relevant rotor disc; the blades are located by means of a hardened hollow steel pin. This form of blade mounting has proved particularly successful.

To prevent the escape of compressor seventh-stage air between the combustion system inner casing and the main turbine shaft, a labyrinth seal is carried on the eighth compressor rotor disc. The large diameter at which the seal occurs involves high sealing velocities. Because of this, and of the need to provide for manufacturing and assembly eccentricities, it was decided to incorporate a carbon ring as the stationary portion of the seal. Carbon

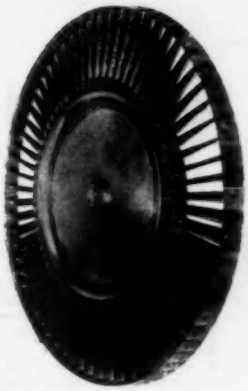




The inner and (right) outer flame-tubes. Closely spaced "wriggle strips" admit cooling air to the inner faces of the tubes. Air is ducted to the 17 swirlers in their perforated platforms.



(Left) The first-stage nozzle assembly utilizes hollow blades, for both structural and cooling reasons.



(Right) Familiar fir-tree serrations are used to attach the turbine blades to their discs. The second-stage assembly shown here is attached to the first by an inter-stage drum and is spigotted to the mainshaft.

GYRON . . .

segments are shrunk into a circumferential steel carrier ring which is attached to the inside of the forward entry duct and spring-loaded to permit a limited radial movement. With the engine running, the rotating labyrinth moves the carbon seal to a concentric position, and only a slight rubbing of the carbon occurs. As engine r.p.m. are increased the higher compressor air delivery pressure holds the seal firmly against any further movement. Some of the original seals are still in use on Gyron development engines.

To supplement information on compressor performance gained during engine running, rig testing of individual compressors was undertaken. This work was performed on a 2,500 h.p. closed-circuit rig at C. A. Parsons, Ltd., and initially a six-stage unit was built and tested. During 1954 and 1955 further testing of an intensive nature was performed on a seven-stage compressor at the National Gas Turbine Establishment and a useful measure of overspeeding was also undertaken. The performance results obtained confirmed those predicted during design.

At the Company's new gas dynamics laboratory at Hatfield, named the Halford Laboratory, extensive rig testing of a thin-bladed lightweight design of compressor was completed early in 1956. Performance investigations have similarly been made of special single-stage compressors and of compressors having variable incidence first-stage stator blades. These tests, and the handling of the engine on the test-bed and in flight, have shown the Gyron to be capable of an exceptionally high rate of stall-free acceleration—three seconds from flight idling to full thrust.

In addition to the thin-bladed compressor, a lightweight titanium-bladed compressor has also been tested. The rotor of this unit incorporated four discs also machined in titanium alloy. The engine concerned was tested to a high rating and with reheat developed 23,000 lb thrust.

The forward entry duct, interposed between the compressor and the combustion system, forms the backbone of the engine. In view of the ambient temperatures to which it is subjected, it is produced as a fabricated structure in Fortiweld steel and comprises two double-walled drums forming the diffuser outlet from the compressor. Seventeen streamlined struts have the dual role of carrying the loads from the inner drum to the outer drum and of supporting the flame-tube assembly at its forward end.

Bolted to the rear of the inner drum is a further pair of drums fabricated in Fortiweld. The outer is a non-stress-carrying item which defines the inner wall of the combustion system, and the inner drum is slightly conical and extends as far as the front of the turbine entry duct. At this point a further conical drum, also in Fortiweld, extends rearwards to carry the rear main bearing housing. A large flange at the forward end of this second conical drum provides attachment spigots for the inner portion of the turbine entry duct and for a fabricated conical baffle unit which is provided for directing the flow of cooling air over the turbine disc.

The combustion chamber of the Gyron was the greatest unknown in the design of the engine. In its original form it comprised an annular snout, a swirler-plate assembly and an inner and outer flame-tube, each in Nimonic 75. The outer air casing in Fortiweld steel was also a structural load-carrying member; to the inner air casing reference has already been made. Eighteen Lucas Duplex 3 burners, providing upstream fuel injection, were used.

Reversing air chutes were provided part-way down the flame-tube walls to inject air forwards into the primary combustion zone between adjacent fuel injectors. It was the recirculation of airflow created by these and the swirler air streams that effectively stabilized and anchored the position of the flame. A series of corrugated strips were provided at stages down the flame tube wall to pick off layers of dilution air to skin-cool the entire inner face of the flame-tubes.

The exceptionally high mass flow of the engine prohibited any possibility of providing an adequate air supply to test the chamber at full design conditions, but testing of the chamber on an atmospheric pressure rig was performed at the N.G.T.E. at the same time as the Gyron was first run. Subsequently, a large number of similar tests have been undertaken at the Halford Laboratory. The initial results of this work and early development running on the engine indicated that an unsatisfactory turbine entry temperature pattern prevailed. Several re-designed forms of chamber were tested, including an eleven-burner configuration having convoluted inner and outer flame-tubes with the object of obtaining a more uniform supply of air to the fuel sprays.

As a result of this work, modifications were made to the dilution air ports. When tested on an eighteen-burner chamber in an engine these indicated that an appreciable improvement in turbine entry temperature conditions had been obtained. It was largely this change which enabled the attainment of 20,000 lb thrust by the Gyron DGy.2. The final choice of a seventeen-burner arrangement was made as a means of avoiding certain resonant conditions in the turbine blading.

Subsequent extended running at high engine thrust showed the need for a further improvement in the radial temperature gradient at entry to the turbine, to prevent stretching of the first-stage turbine blades. It was determined that changes were required in the primary-zone burning conditions. These were achieved by the introduction of ducted swirlers rather than the more conventional single annular snout. This latter component was modified to split the incoming airflow from the compressor into two streams. From the inner one of these, primary air for combustion is individually ducted to the seventeen swirler plates, thus providing a more uniform and direct supply of air for this purpose.

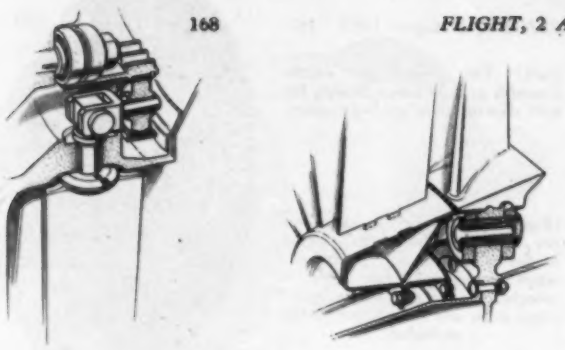
Joining the compressor rotor to the turbine is the forged S.97 steel mainshaft, machined to an exceptionally thin wall-thickness over the major portion of its length. The trumpet profile of this component was developed to provide a shape capable of resisting the centrifugal loads in the shaft at high rotational speeds. The shaft is supported at its rear by the main single-row roller-bearing assembly and stator casings.

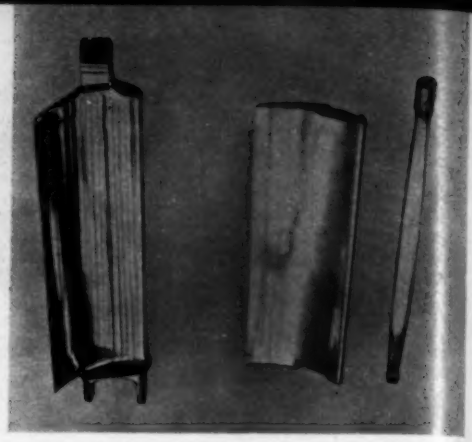
To ensure that the two turbine discs are held concentric with one another and with the mainshaft, it is arranged that the first-stage disc is located on the shaft by means of a Hirth coupling, while the second-stage disc is attached to the first by means of an inter-stage drum fitted with dowels. The forward portion of the Hirth coupling is carried on splines over the rear of the mainshaft and the rear half of the coupling is machined directly on the front face of the first disc. Radial growth of the disc is permitted by the radial disposition of the teeth of the coupling; and, to ensure that adequate flank contact of the teeth is maintained under all flight conditions, a large ring-nut abuts against the rear face of the first-stage disc.

The first-stage disc is a forging in Firth-Vickers Rex 448, and the second-stage disc, which is also spigotted at its centre to the rear of the main shaft, is a forging in William Jessops H.40. Both of these materials are heat-resisting ferritic steels. The turbine blades are fully machined from Nimonic 100 forgings for the first stage and Nimonic 90 for the second stage, and are retained in the discs by five-serration fir-tree root fittings. Nimonic 75 rivet pins at the apex of the fir-tree fitting lock the blades against endwise movement.

The first-stage nozzle blades are formed to shape from Nimonic 80A sheet, seam-welded along the trailing edge. The tie-rods previously mentioned pass through these to the outer shroud ring, which also carries the engine rear-support linkage. To accommodate radial expansion and blade torque reaction, the nozzles are carried in profiled slots cut in the inner and outer shroud rings. The inner shroud also forms one side of an annular box which is supplied with a bleed of compressor delivery air passing inside the blades to cool them. Both the turbine and nozzle blades are surrounded at their tips by inner and outer shroud rings cooled by the rearward flow of air passing between the rings before it exhausts into the gas stream at the trailing tip of the second-stage blades.

The second-stage nozzle blades are of necessity cantilever-mounted from their outer shroud ring. They are fully machined





(Sketch, left) Operation of the variable-incidence inlet guide vanes. The actuator ring—supported on a row of bearings—carries a series of spherical bearings locating the vane swivel arms. (Sketch, right) This typical compressor detail shows the shrouded stator blade roots and the hollow swivel-pin attachment of the compressor blades. Inter-stage sealing is effected by a controlled clearance between individually machined brass labyrinth seals and the compressor rotor drums. The formed sheet first-stage nozzle blades house the tie rods (extreme right) supporting the inner shroud ring and rear main bearing. Second-stage nozzle blades are pin-jointed to their shroud rings.

GYRON . . .

from solid Nimonic 80A forgings and have a single-tang and double-tang fitting at their inner and outer ends respectively. The blades are pin-mounted to the inner and outer shroud rings *via* these tangs and are assembled with an offset angle from a truly radial position; in this way expansion of the blade length is accommodated by slight rotation of the inner ring. Such an arrangement has the additional advantage that a certain proportion of the gas bending-loads on the nozzles is taken in tension rather than in pure cantilever bending. A sheet-metal labyrinth seal is mounted off the inner shroud ring. This acts in conjunction with the inter-stage drum to prevent axial leakage of the gases between the two stages.

During development testing of the engine, fatigue failures of the root profile form and of the serrations occurred in both turbine rows. These were determined as being caused by sixth-order excitation in the first stage and third-order excitation in the second stage. It was for this reason that the number of fuel injectors in the combustion system was altered from eighteen to seventeen. The serration failures were caused by stress concentration set up by inequality of stress-flow from the blade platform into the root.

After a considerable amount of design and test work, it was concluded that for engines rated at 15,000 lb—and in particular those intended for flight testing—the best compromise to combat fatigue conditions was the use of shrouded Nimonic 90 first- and second-stage blades. Conversely, for the higher-rated, higher-temperature engines, it was necessary to replace the Nimonic 90 first-stage blades with buttressed, unshrouded Nimonic 100 blades. These latter have a much thicker profile near the blade platform and are better suited to resist fatigue conditions at the higher temperatures.

A straightforward design of exhaust cone assembly fabricated largely from Nimonic 75 sheet is fitted. The construction of this is apparent in the cutaway drawing.

Air System. A tapping of air for cooling purposes is bled from a ring of holes in the inner casing of the combustion chamber. A portion of this air is directed over the front face of the first-stage turbine disc and escapes into the gas stream at the periphery of the disc. A further portion of the air passes through a series of holes drilled in the first-stage disc and flows under the inter-stage drum. Slots cut in the rear flange of this drum permit the air to escape into the gas stream at the periphery of the second-stage disc. The remainder of the cooling air passes up the first stage nozzle blades and thence between the pairs of turbine and nozzle outer shroud rings.

Fuel System. The complete fuel system on the Gyron has been supplied by Joseph Lucas (Gas Turbine Equipment), Ltd., who also largely developed the annular combustion system and the atomizing fuel-injection system—the first to be fitted to a British engine with a large annular chamber. The fuel system comprises two G.D. size multi-plunger, variable-delivery pumps, a proportional-flow control unit and a flow distributor. Provision is also made for electric speed and temperature over-ride trims. The proportional control unit consists of a throttle valve/shut-off cock and linking valve forming the flow transformer, an acceleration control and constant-idling-flow valve. A separate assembly contains the altitude-sensing unit, which, with the flow transformer, forms the scheduling control.

A further unit, the electro-pressure control, contains the secondary-flow control orifice and also receives amplified signals from an engine-driven alternator and the jet pipe thermocouples. The signals vary the secondary flow and so provide speed and temperature trim to the scheduling system.

Lubrication System. A dry-sump system supplies oil (spec. D.Eng.R.D. 2487) under pressure to the front bearing, centre-housing gears and bearings, and rear bearing. Oil from the front bearing and centre housing drains back into the sump *via* the lower intake strut; oil is retained in the rear bearing by piston-ring seals fore and aft of the rollers. A pump passes scavenge oil to the top of the integral oil tank around the intake casing. A fuel-cooled oil cooler (not shown on the sectional drawing) is proposed for cooling the oil under high forward speed conditions.

Starting System. The engine is started by either a 45 h.p. 110 volt D.C. Rotax electric starter motor or a de Havilland hydrogen peroxide turbo-starter. The starting times that can be achieved by these two systems are known to be in the order of 30 sec and 10 sec respectively. The starter is linked to the main rotative assembly by reduction gearing (each system has a particular reduction ratio) and an extension shaft from the front of the compressor rotor.

Constituting a highly important aspect of the overall programme on the Gyron has been the research and development work performed at the Halford Laboratory. This establishment is extensively equipped with the necessary facilities for rig testing of the major components of the engine and the related intake and exhaust systems.

Because of the large size of the Gyron and the very high powers and air mass flows involved, certain of this work has been more conveniently performed on components of the scaled-down Gyron Junior. Examples include the compressor and compressor stage testing mentioned previously, together with atmospheric tests of the combustion system and cold-flow tests of the Junior turbine. Information obtained from static and rotating rig tests of Gyron Junior cooled turbine blades has also been used in the design of blades for the larger engine.

There is sufficient similarity between the two designs of engine to enable further comparisons to be made. By using the compressor test rig in the Halford laboratory, supersonic ram air conditions can be applied to a Gyron Junior on an adjacent test-bed and should provide accurate information applicable to the Gyron engine family. Various fundamental types of supersonic intake are being investigated by a programme of model research. Facilities are now available for testing small-scale intakes up to Mach 2, but plans are in hand by the de Havilland engine company for a 24in-square-section tunnel capable of operating at Mach 3—the flight conditions intended for the Gyron.

Development of this large, ultra-powerful engine is witness to the forward thinking of its makers in their determination to ensure that a developed supersonic engine is available in advance of the requirements of the aircraft manufacturer. In particular, the mixed rocket-plus-turbojet powerplant formula has been closely studied and the Gyron has been considered for installation in the projected designs of a long-range supersonic bomber, supersonic fighter and cruise missile.

With the re-shaping of the national defence policy announced earlier this year in the Government's White Paper on Defence, it was declared that with the evolution of guided missiles for both offensive and defensive rôles the Gyron (after over four years of development work and 2,000 hours of bench and flight testing) would no longer receive Government financial support. This might have sounded the death knell of a less imaginative or a less successful project, but the practical interest shown in the engine by the industry—in particular by the Hawker Aircraft Company (who, it is announced, are to use the Gyron in their P.1121 prototype supersonic aircraft)—decided the de Havilland Engine Company to proceed with the development on a private venture basis as before. Adequate backing, they say, is being provided for flight engines for the P.1121 and other forthcoming aircraft.

Leaves from a Log-book

Memories of Earlier Service Days

By PATRICK JOHNSON

A PILOT who will be remembered for surpassing airmanship as long as the fame of the R.A.F. lives on is W. E. P. Johnson, A.F.C., C.P.A., A.F.R.Ae.S. In printing these reminiscences of his (further instalments of which will follow) we are confident that they will appeal as strongly to all "new boys" of the right stamp as to the older hands who were fledged on 504s, Snipes, Gamecocks and the other fabulous biplanes of the twenties and thirties. In later years he was prominent in the development of jet propulsion; and, as European representative of the Solar Aircraft Company, he is still very much in the aeronautical picture.

IN 1916 I was thirteen, and I had a brother in the Royal Flying Corps. True to the lawless spirit of initiative in that epoch, he took me up in a B.E.2C. After that glorious experience—and it was glorious, for we flew over the skeleton of a Zeppelin destroyed in part by that very aeroplane a day or two earlier—nothing would stop me infesting aerodromes. I spent months of school holiday actually living on them. By 1918 I had about 80 hours of flying in the log-book I meticulously kept; I had flown in and (unofficially) flown B.E.2C, Avro, F.E.2B, Handley Page and D H.9. And once I had been mildly crashed.

In the doldrums of aviation between 1918 and 1925 I scraped up a few five-bobs to spend with joy-riding outfits. In 1925, when the London Aeroplane Club was formed, I joined as Member No. 16 and was as frequent a pupil as my student's pocket-money would run to at 30s per half-hour. I had a lot of fun learning to fly alongside such pupils as Mrs. Elliott-Lynn, Lady Bailey, Philip Lucas and Amy Johnson (who, I am sorry to say, was not a relative).

This was on the original, almost primaeval, type of Moth, and we flew at Stag Lane, which is now solid houses. It was a defect of that airfield—and one which I believe did much to ensure that the makers of the Moth knew all about undercarriage design—that its surface went up and down. There were points from which, sitting in an aeroplane, you couldn't see another one a couple of hundred yards away; and there was some choice as to whether one landed or took off uphill or downhill. In those days, airmanship was an art.

By this time I was utterly in love with the air. I think I lost my heart the first time I flew over cloud. Nowadays, millions of people a year fly in or over cloud and I'm sure that, save for the most cynical, they cannot do so without a strong feeling that at such moments humanity reaches a spiritual summit. I also fell in love with the clouds themselves; but this is a love which was not reciprocated—clouds are enchanting from one aspect, threatening from another, and, generally speaking, nasty to be swallowed by.

In love, twenty-three, qualified in my ground job, but too young to practice it—that was me in 1926. So I joined the Royal Air Force. I was granted a short-service commission and sent to the flying training school at Netheravon. Here was assembled a miscellaneous and extraordinary cross-section of male humanity, to be turned into officers and pilots. For six months we spent hours sitting on chocks waiting our turn to be taught flying on Mono Avros. The Mono was a curious aircraft. It was also an invaluable one, training pilots for many years. Its rotary engine was about as unreliable as any life-sustaining apparatus has ever been. It ran on a little petrol and a lot of pure castor-oil—a lot simply because the oil was continually spewed out of the engine for inhalation by the pilot. To this day, the smell of half burnt castor-oil gives me a nervous, if pleasant, thrill.

With the exception of Philip Lucas, who joined the R.A.F. with me, I was one up on the rest of the pupils, because I had flown before. Traditionally, people went solo after about eight hours of dual instruction. Naturally enough, he and I were fit for solo in a very short time. We tried hard to appreciate this as an advantage, but it actually meant that we got in less flying than the others. In six months we did the standard 25 hours on Avros—and how we chafed!

I had a marvellous instructor, called Sutcliffe, who at the time of writing is still actively concerned with flying. With very few exceptions, every pupil's instructor is marvellous, and it was only in later years that I realized that mine *really* had been. It was his pleasure sometimes to fly very low across Salisbury Plain, and I well remember one incident, when we and another Avro pilot chose to fly alongside a train which was steaming from Andover. I can't think why, but after a little time the fireman started to bombard us with lumps of coal. In those days that sort of thing happened. There was reputed to be an incident in which an aeroplane was trundling alongside a train full of trippers down in Kent. The pilot noticed that the carriage windows were packed with interested spectators, so he hopped over to the other side, whereupon the passengers crossed their compartments to the other windows. By repeating the process somewhat smartly he actually got such a roll on the train that its crew thought there was something wrong, and stopped it miles from anywhere, whereupon the merry fellow went on his way rejoicing.

I have mentioned the unreliability of our engines. They were indeed wonderful—wonderful and fearful—but the very devil to maintain, and forced landings caused by engine failure were extremely common. My first was not due to that, but was occasioned by losing my way while flying from Gosport back to Netheravon on my first cross-country. I couldn't resist flying through some cloud, and when I popped out expecting to be over Salisbury, I couldn't recognize anything. The one piece of ground I couldn't see was the bit directly underneath, and I was in fact vertically over Salisbury, and didn't know it. I went on flying, following the railway, and finally landed in a field. I asked a farmhand where I was, and he said "Gillingham." The only Gillingham I knew was in Kent, and I really couldn't see how by flying west from Gosport I had finished up east; nor could I think what had happened to the Thames Estuary. The thing sorted itself out when I learned of the Dorset Gillingham. Contrary to all the rules, I got the farmhand to swing the propeller, and got back to Netheravon just before I would have been reported missing.

The next step in our training was the Bristol Fighter. This was (and the sole example flying still is) a real aeroplane. I don't recall exactly what its performance was, but compared with the Avro (which did the world's flying donkey-work for a decade and a half) the Bristol Fighter was a racehorse. Moreover, it was extremely reliable. The Biff, as it was called, was warm, firm, purred like a cosy cat, was as strong as an ox, and could be thrown round the sky. I well remember seeing three instructors flying three Biffs in formation, and their leader diving so low on to Netheravon aerodrome that his two companions literally flew into the ground, bounced about a hundred feet, still at full speed, and circled to normal landings, having reunited in formation. Their rigging looked a bit out of date, but had held together. As good instructors, they afterwards said, simply and nonchalantly, "Just shows you what a Biff will take." This almost persuaded the pupils that flying into the ground at 120 m.p.h. was done for the express purpose of demonstrating how safe it all was.

The Bristol Fighter was safe enough but, looking back, I'm not so sure about the driver. On my first Biff cross-country—Netheravon to Duxford—I flew back at the regulation 2,000ft, and just south of Newbury the engine stopped. The sight of a large stationary propeller blade looming over the radiator cap is not heartwarming. However, there was a drill to be followed—nose down, pick a field, glide to its leeward side, look round the cockpit, turn off petrol and switches, S-turn towards the field, final turn in, overshoot rather than undershoot . . . at which point I realized that my field, instead of being reasonably large and still hundreds of feet below, was unreasonably small and quite near my undercarriage. I had picked the highest field in Wiltshire—940ft above sea-level, I believe. I violently side-slipped (obviously useless), and half-way across the little paddock found myself doing about 90 m.p.h. at ten feet; so I decided to go into the far hedge, wing-tip first (Biff wings were good shock-absorbers).

Skidding like mad, I then realized that the hedge about to be used as arrester gear was a scraggy attenuation of sparse hawthorns and rusty barbed-wire, and that there was no ground on the far side. So I gathered up the aeroplane, heaved back the stick, and hopped the obstacle. Of course, the result was a complete stall—nose down about 60 deg. I stalled into an abyss, regained flying speed, glided three-quarters of a mile across the valley, was con-

"By flying the Snipe I learned the real joy of aerobatics." [The Snipe depicted, with the author up-front, is one of the rare two-seaters.]

LEAVES FROM A LOG-BOOK . . .

fronted by a strip of grass about three Biff-lengths long with 45 deg upward slope, and stuck the Biff against it like a fly landing on a wall. We ran ten yards uphill, the tailskid spragged right in when we started to reverse, and out I jumped intact except for incipient heart-failure. Next morning, it took full engine and a three-ton truck towing to get the long-suffering aircraft to the top of the slope, and my instructor Dicky Bain flew it back to Netheravon. I went back to have a look, and found that the precipice I had stalled over was about 400ft high, and too steep to climb on foot.

After 75 hours of total time, half on Avros and half on Biffs, we were through our course, and deemed qualified to defend the King's Realm, or confound His Majesty's enemies. But for a few of us a further delight awaited. Five of us were told we were going to be posted to single-seater fighters, which, in those days, were the glamorous thoroughbreds of the Force. They were certainly well-bred, but compared with their successors of today they had the breeding of a dowager rather than of a greyhound.

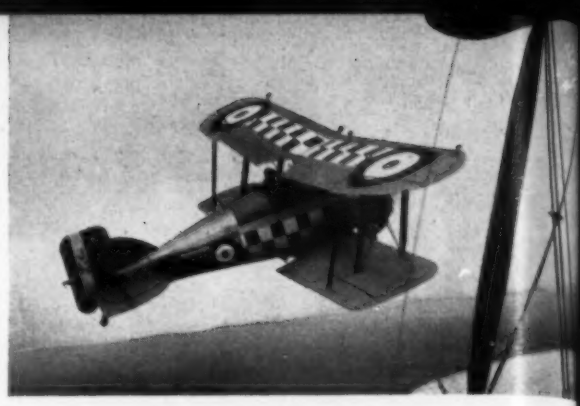
To qualify for this duty we had to learn to fly Sopwith Snipes. I believe we had the last five Snipes in the R.A.F. They were brought to Netheravon after some five hard years of work at another flying training school, and they showed their age. The Snipe had a 200 h.p. rotary engine, which was a honey when all went well. But because of its stubby little fuselage, and this monstrous great flywheel of an engine up front, the Snipe was somewhat tricky. For instance, to cope with the spinning-top effect of the engine, you had to put on a lot of left rudder in a left-hand turn, and a lot of left-hand rudder in a right-hand turn, for which reason you were not allowed to do right-hand turns below 500ft. It was a point of honour as well as controlled indiscipline to do right-hand climbing turns off the ground; but it was as well not to do them within eyeshot of one's instructor.

By flying the Snipe I learned the real joy of aerobatics. I also acquired a Snipe trademark—a dark patch on the shoulders of my uniform, due to frequent soaking in oily petrol when flying inverted. The stain was produced by a cunning device in the form of some sort of petrol-tank breather-pipe, and at several thousand feet (with no parachute—we didn't yet have them) a literal cold chill down the spine was the reward of inversion.

Five hours saw us through the Snipe course. Lucas and I were posted to 43 Squadron at Tangmere, equipped with Gamecocks. Happily, Tangmere was a new station, and 43 had only recently been reformed, having been disbanded for some post-war years. For its purpose the Gamecock was the best aeroplane of its generation. It was a compact and stubby little biplane, good for about 150 m.p.h. on the power of the lovely Bristol Jupiter air-cooled radial.

After three practice landings on a Grebe, I was turned loose on my own. My Gamecock, a new one, spread half England out under me practically whenever I wanted. Philip Lucas had a complete engine failure on his very first flight, and this was really extraordinary, because I had never before (or since) heard of a real failure, either of the Gamecock or of its Jupiter. He pulled off a perfect landing, right in the circle on the aerodrome, with a completely dead engine, within three minutes of taking off. His example did a lot for my confidence.

We flew all the morning, and were then free. I had a sailing boat in Chichester Harbour, only a few miles away, so I could



"For its purpose the Gamecock was the best aeroplane of its generation." [In this picture W.E.P.J. is flying J8421 of No. 43 (F) Squadron.]

fly as I wished in the morning, have a good lunch, sail all the afternoon, come back to dinner, and then perhaps put in an hour's night flying; and so to bed.

Night-flying reminds me of one aspect of the development of flying since then. We had no radio, and of course there were no runways, or fixed lighting systems. A tee was laid out—composed of a number of objects like watering-cans with wicks in their spouts and full of paraffin—and this formed the famous "flare-path." With luck, the tee headed into wind. Ground-to-air signalling was by flashing a light in Morse code.

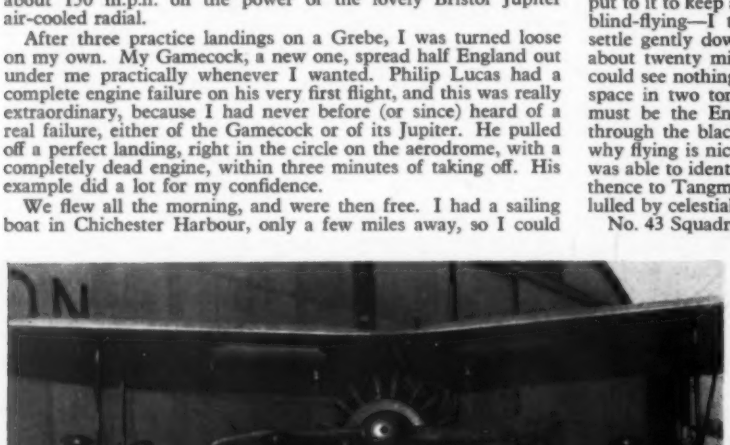
A first night flight was quite an experience, the only instruction being by way of homily from one's flight commander. I was told on no account to undershoot, that being a common fault. For my first landing I came in high and throttled back to glide in, looking out to starboard. It was then that I saw a fire in the generator, which was mounted in the starboard lower wing. Text-book action was to side-slip away from a fire, so I went into a violent slip to port. The book also said to turn off the petrol and open the throttle. This I did, and, oddly enough, the fire went out. With some trepidation I turned on the petrol again. Everything seemed normal, and I made a normal landing, somewhat tremulously but adequately. Expecting the whole thing to go up at any moment, I taxied off the flare-path—and realized that my fire was simply the normal exhaust-flame of a throttled-back Jupiter. Nobody had told me about that.

I was once flying at about 16,000ft when, hypnotized by the beauty of the night, I suddenly found myself swaddled in cloud so dense that one could almost touch it. I climbed to 18,000ft and realized that it was almost certainly a towering thunderhead. Much put to it to keep an even keel—this was before the development of blind-flying—I trimmed the Gamecock to glide, and left it to settle gently down at 75 m.p.h. The glide must have taken me about twenty miles before I broke cloud at 1,000ft, and I then could see nothing whatever; not a light nor a star, just an infinite space in two tones of black. The darker tone below I thought must be the English Channel, so I headed north by compass through the blackness. It is at such moments that one wonders why flying is nice. At last I saw ahead a distant bright flash and was able to identify it as the Nab Light, east of the Isle of Wight; thence to Tangmere was easy. I never again allowed myself to be lulled by celestial beauty into loss of bearings.

No. 43 Squadron was then, as it is now, notable for its aerobatic competence. A few years later, when the squadron was re-equipped with Furies, it performed at Hendon, doing beautifully controlled formation manœuvres with each aircraft tied to its neighbour by ribbons, which remained intact from take-off to landing. I had left the squadron by that time; but I was very proud to bask in its reflected glory.

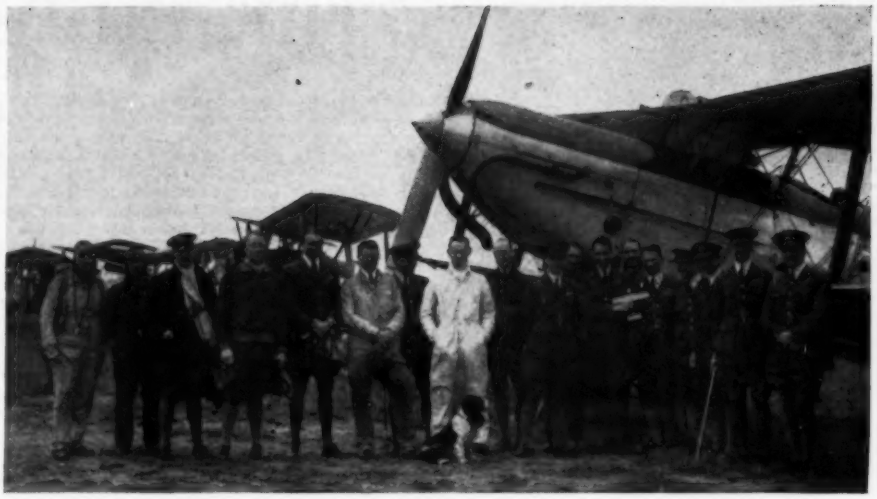
After hundreds of hours even Gamecocks become a little boring and I hankered after a more constructive job of flying, so I put in for an instructors' course and was sent to the Central Flying School.

First, however, I went to a summer training camp at Sutton Bridge, on the Wash. This was the annual opportunity to fire our guns, which were singularly unreliable weapons. They were usually adjusted for alignment in the aircraft by squinting up their barrels at a temporary target placed 200 yards away. Often the target was a spare aircraft wheel held by a bored airman out on the field. One day, when this routine was being performed at Sutton Bridge, a Siskin of



"A" Flight of No. 43 (F) Squadron, Tangmere, 1927, commanded by F/L. Britton. [The author is on the flight lieutenant's left.]

LEAVES FROM A LOG-BOOK . . .



Instructor staff of the Central Flying School during 1931. The aircraft represented in this "Flight" photograph are Fairey IIIF, Gloster Gamecock, de Havilland Moth, Armstrong Whitworth Siskin and Bristol Bulldog.

another squadron came in to land. It was a convention in those radioless days that if an aeroplane was seen to have a damaged undercarriage someone on the ground would stand conspicuously holding a wheel and trying to indicate whether the damage was port or starboard. The pilot of the Siskin, noticing our temporary target, drew the natural conclusion. He very gingerly touched one wheel down, found it all right, went round again and touched a second wheel down, and was puzzled to find all was well. Assuming that there must be something completely wrong with the whole undercarriage, on his third circuit he took crash-action by turning everything off during the glide and dropping the aeroplane from about twenty feet. We found the sight of a perfectly good Siskin being deliberately crashed to be extremely funny. The misguided pilot was unscathed, but he had an awful time living it down afterwards.

When my course began, C.F.S. had moved up to Wittering, near Stamford, an aerodrome which many people know because it borders the Great North Road. The C.F.S. was the oldest unit in the Service and was a wonderful station. There was a considerable variety of aircraft—Lynx Avros, D.H.9A, Bristol Fighters, Grebes, Gamecocks, Siskins and occasional stray types sent there for trial as instructional aircraft. The C.F.S. had a great tradition, as it still has. Its job was not only to train instructors but also continually to analyse flying techniques, and to study the adaptation of the existing techniques to various new types of aircraft.

The C.F.S. was also a show-place—the *haute école* of flying—in that we had a constant flow of foreign pilots and officers. The system of instruction devised by the school was the pattern for flying training all over the world. The methods were based largely on the precepts of the late Major Smith-Barry, who inspired what was known in the early days as the "Gosport school." These precepts are a little too complicated to describe here, but great weight was attached to morale; staff instructors were expected to be perfect, and the appearance and smartness of the station, its men, and its aircraft were maintained at the highest standard. A great deal of latitude was allowed to the individual pilot, who was encouraged to use his initiative in the actual teaching of flying. Latitude was also allowed to the pupil—he was expected to make mistakes and was then taught in a conversational manner what to do to extract himself from whatever predicament he had initiated. This evoked from the instructor not only great patience, but an exact knowledge of precisely how far a pupil's mistake might be allowed to develop into real danger before the instructor himself took corrective action.

All the instructional aircraft, of course, had dual, but it was considered important that the instructor should never grab the controls and take over from the pupil unless it was literally a case of averting a crash. The instructor had to learn to endure all manner of inadvertent manœuvres and attitudes, quietly talking the pupil into taking appropriate action to put things right. Looking back, it is quite extraordinary how well it worked. During the many hours I put in as an instructor I recall only two cases of having to take over from the pupil. These were both with the same man, who, because he was nervously unfitted to fly, froze on to his controls during spinning practice. On one occasion I had to save his life (and mine) by violently pinching the calf of his leg when he was frozen on to full rudder and we were still spinning at a few hundred feet. In that type of aircraft, fortunately, his leg was within easy reach.

The course at the C.F.S. took three months, and on qualifying as an instructor I was posted to a newly forming F.T.S. at Grantham. Three other instructors and myself arrived there to find empty buildings and a handful of men. We had eight days before the first course came in, and we had to acquire everything from beds to beer for the mess, and from aeroplanes to earphones for the flying. We collected the aeroplanes by borrowing an Avro, two of us flying over to Manchester to collect a second one, then four of us going over again to collect two more, and so on. By the evening of the eighth day the mess was a going concern and we had about 150 airmen comfortably fed and housed and enough aeroplanes to cope with the first 30 pupils.

It was a great adventure to begin the teaching of a brand-new batch of pupils. My first three were Hamish Kerr, Max Oxford and Jack Addison. They were my constant preoccupation for six months, and I am sure no three pupils ever had such a painstaking or ignorant instructor.

We had a system in those days whereby a pupil had long streamers tied to his wing-up struts. One day I was teaching Hamish Kerr how to do a flick roll when I noticed that one streamer had tied itself in a neat half-hitch around a nearby bracing wire of the rigging. We did a flick roll the other way, and the other streamer became half-hitched. This gave me an idea, which I afterwards put into practice. For the time being, however, it resulted in my arranging competitions between my pupils as to who could most quickly get up to a reasonable height with his streamers streaming, and get down again with both of them half-hitched—which meant, of course, that both a right and a left flick roll had been carried out with accuracy. What actually happened was that the roll involved momentary stalling at least of the tip part of the wing, bringing a reversal of airflow over that part. The wind, instead of coming from ahead, came from astern, and the streamer turned like a weathercock and wrapped itself round the rigging.

I later developed a complete lesson in elementary theory of flight, in which I had my aeroplane festooned with lengths of white tape to act as streamers. With this—inevitably called wedding rig—I used to demonstrate the actual airflow over various parts of the aeroplane in various manœuvres. It was a fascinating exercise, and nothing I said in a classroom was half as valuable as ten minutes of actually watching things happening in the air.

Another kind of competition I had with my pupils very nearly caught me out. It was part of the tuition to emphasize that a pupil should never get into a situation where, if his engine failed, he could not land in one piece; it was standard practice for the instructor suddenly to cut the engine, just to see what a pupil would do. I had an understanding with all my pupils that when I was flying the aeroplane they could do the same. On one occasion I was doing a quick check with a pupil, and as I foolishly flew at about 50ft down-wind over a considerable wood he cut the engine on me. I was determined not to submit, and we were just able to scrape over the trees into a tiny field, and land dead across wind. I couldn't risk taking off again at full load, so the wretched chap had to get out and walk back to the aerodrome, carrying his parachute, whilst I flew back. I don't recall any of my pupils carrying matters quite so far again.

I lasted about a year at Grantham, and was then posted back to the Central Flying School and attached to a unit called the Refresher Flight, the main duty of which was to receive miscellaneous pupils whose requirements were somewhat special. We received people who, for one reason or another—for example, a serious crash—were badly out of practice; we coped with occasional foreigners, where the disability of language, or the shortness of their stay, required special treatment; and, in general, we were the handymen of the corps of instructors.

(To be continued)

THE INDUSTRY

Lt-Gen. Lord Weeks, at the Vickers-Armstrongs (Aircraft) apprentices' prize-giving, presents a scholarship certificate to J. W. Abernethy. The occasion is recorded in a news-item below. Lord Weeks has taken a particular interest in the training of apprentices.

Weybridge Prize-giving

OVER 150 apprentices of Vickers-Armstrongs (Aircraft), Ltd., received awards and prizes when the company held its speech day at Weybridge recently. This was the first formal occasion of its kind, and it marked the coming-of-age of the aircraft company's apprenticeship scheme. Awards for the session 1955-56 were presented by Lt-Gen. Lord Weeks. Formerly chairman of Vickers, Ltd., Lord Weeks inaugurated the current programme of extended technical education within the Vickers Group, which now employs over 5,000 apprentices.

Some 300 parents of award-winners and first-year apprentices attended the ceremony. Sir George Edwards, managing director of Vickers-Armstrongs (Aircraft), Ltd., presided, and Mr. H. H. Gardner, chairman of the Vickers Group Committee on Education, spoke of the company's future training plans in the light of aeronautical progress. Reviewing the session 1955-56, Mr. E. G. Barber, education officer, reported that over 1,000 applications had been received for 160 apprentice places in that year's intake.

Winners of the principal scholarships and awards were as follows: Vickers-Armstrongs (Aircraft) Scholarship and Group Supplementary Award, D. Tisdall; Vickers-Armstrongs Scholarships, J. D. W. Abernethy, B. Graham and H. G. Edwards; Pam Newton Memorial Trophy (best trade apprentice of the year), D. Williams; best first-year apprentice, J. D. W. Abernethy; best final-year apprentice, C. Torkington; apprentice making most academic progress, B. J. Dyble; apprentice making most effort to further the corporate life of the apprentices, A. J. Brennan.

Argonarc Welding Developments

VARIOUS developments in Argonarc welding techniques were recently demonstrated by British Oxygen Gases, Ltd., of Spencer House, St. James's Place, London, S.W.1. By one of the new processes, for the cutting and profiling of aluminium plate by means of a gas-shielded electric arc, aluminium plates of up to 1in thickness can be cut at very high speeds, using either oxygen-free nitrogen or other inert gases.

Cutting action is produced by a constricted arc of high temperature and velocity being struck between a tungsten electrode and the surface of the metal. The arc is surrounded by a shielding gas. The concentrated energy of the arc stream melts and ejects a thin section of metal to form a kerf, and the result is a clean-cut edge with little or no adhering dross.

A new arc-length control unit has also been developed by British Oxygen. The equipment was primarily developed for use with automatic welding machines and longitudinal and circumferential welds in thin-gauge material can be made. The unit is designed to overcome any irregularities in the joint—irregularities which might be present even when the parts are held in a fixture. The required length of arc is preset on a dial and once the arc has been struck the arc voltage is constantly monitered and is used to indicate where the preset length is being maintained. Where it is not, a servo-circuit is energized to move the tungsten electrode either toward or away from the work to re-establish the nominal conditions. The equipment can be used for either A.C. or D.C. welding and for either fixed- or consumable-electrode work. This type of equipment is used for the welding of gas-turbine engine components, rocket-motor tubes and continuous stainless steel tube.

The Argonarc spot-welding process has been available for a number of years and has the advantage that a spot-weld can be made between two parts when accessible from one side only. A disadvantage of the process in the past, however, was that it proved to be inconsistent in operation and resulted in severe cratering and cracking in the fused zone. To prevent this the weld nugget must be allowed to cool slowly, and British Oxygen have now introduced a system of control which achieves this end and results in consistent spot-welds. A D.C. rectifier is used as the power source and control is effected by the introduction of resistances in the magnetic amplifier control circuit. The current at the end of a welding cycle is successively reduced to zero in four stages. The equipment used consists of a D.C. power source, a timing control and a torch normally positioned by hand over the work-piece and contains the electrode. A trigger switch incorporated in the torch handle initiates the timing circuit and the arc can then be struck for a predetermined time. The arc is shielded by argon during the spot-welding process.

An experimental rig by British Oxygen Gases (see above), showing the application of the Argonarc spot-welding technique for joining the web members of a torsion box to the skin.

IN BRIEF

Messrs. C. C. Hall, Andrew Smith, D.S.C., C.A., A.C.W.A., and A. R. Spidy have been appointed directors of the Walter Kidde Co., Ltd.

* * *

The caption to the Vickers-Armstrongs Valiant photograph on this page for the issue of July 19 should have made it clear that the nose radome was moulded in reinforced laminated plastic material by Marston Excelsior, Ltd., with a covering of neoprene supplied by the Goodyear Tyre and Rubber Co. (Gt. Britain), Ltd.

* * *

A new research and development company, Rheem-Solartron, Ltd., has been set up jointly by the Solartron Electronic Group, Ltd., Thames Ditton, Surrey, and the Rheem Manufacturing Co., New York. It will work on radar simulation projects and "certain other electronic devices"—including a multi-headed electronic reading machine for commercial applications.

* * *

Mr. C. J. Buchanan-Dunlop, formerly of the Birmingham sales office of the Northern Aluminium Co., Ltd., has been appointed manager of the sales administration division at Banbury; and Mr. J. A. Ambler, formerly head of the metallurgical section of the sales development division, has taken charge of a newly formed market research section of the sales department (also with an office in Banbury).

* * *

Under a recent reconstitution of the Board of Black and Decker, Ltd., Sir Walter Puckey became a director and Mr. F. W. McCartney (assistant general manager) and Mr. W. O. Bell (acting production director) assistant managing director and production director respectively. The company also announce that Mr. Douglas Brown, technical director of Attwood Statistics, Ltd., is to join them in August as contract sales manager.

Plastics products of Bristol Aircraft displayed at the recent British Plastics Exhibition included a new high-speed radar scanner, aircraft drop tanks, and resin-impregnated glass-fibre pressure vessels. On the right, one of these vessels is seen in course of manufacture from strands of the fibre.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

R.A.F. REDUNDANCY: IMPLICATIONS OF THE DEFENCE CUTS

WHEN details were given last week of the run-down in the Services outlined by the Defence White Paper last April, the Air Ministry announced that "as far as could be foreseen" the number of R.A.F. officers and N.C.O.s who would become redundant was unlikely to exceed 700 and 1,000 respectively. In a signal addressed to all ranks of the R.A.F. at home and abroad the Air Member for Personnel, Air Marshal Sir John R. Whitley, said:—

"I can now re-affirm that the run-down will mainly be achieved by the normal outflow of officers and airmen coming to the end of their current engagements of all

Air Chief Marshal Sir Ronald Ivelaw-Chapman, appointed Director of Resettlement.

kinds. The problem of redundancy will therefore be a relatively small one. Overall we need a substantial increase in regular recruitment." Sir John added that there were surpluses or promotion blockages in some ranks, branches and trades, and it would be necessary to clear these and ensure that fresh ones did not arise.

Officers and other ranks within fields in which redundancies arise are invited to apply for premature release or discharge. Whilst the Air Ministry will retain the right to accept or reject applications, and if necessary to retire or discharge compulsorily some who have not applied, it is intended so far as practicable to select for redundancy those who wish to go.

Release Categories

FURTHER signals from Air Ministry have set out methods by which officers and other ranks may apply for premature termination of service under the Government's compensation scheme. That relating to officers says that any of those covered by it who wish to leave the R.A.F. before October 1 next year should apply direct to Air Ministry (A.R.3) without delay and in any case by September 30 next. They should add any reason for requiring release urgently or by a particular date.

The following list details categories of officers who may apply to be released before October 1, 1958:—

General Duties Branch: Group captains of seniority January 1, 1950, or earlier; group captains born in 1910 or earlier; wing commanders born in 1914 or earlier; squadron leaders of seniority January 1, 1950, or earlier; squadron leaders born in 1918 or earlier; flight lieutenants or below in the General List (permanent commissions) who, if pilots, were born in 1918 or earlier and, if navigators, in 1916 or earlier; flight lieutenants and below in the flight engineer category without restriction on age or seniority.

G.D. Branch (Ground Section): Wing commanders fighter control and aircraft control of seniority January 1, 1949, or earlier; wing commanders fighter control and aircraft control born in 1909 or earlier; squadron leaders fighter control and aircraft control of seniority July 1, 1947, or earlier; squadron leaders aircraft control only, born in 1910 or earlier.

Technical Branch: Group captains of seniority January 1, 1950, or earlier; wing commanders born in 1906 or earlier; flight lieutenants and below in the engineer classification who were born in 1912 or earlier and who hold permanent commissions; squadron leaders and below in the engineer classification who are serving on extended service commissions without restriction on age or seniority.

Equipment Branch: Group captains born in 1905 or earlier; wing commanders born in 1909 or earlier; wing commanders of seniority July 1, 1948, or earlier; flight lieutenants and below with permanent commissions and with seniority July 1, 1947, or earlier; flight lieutenants and below with permanent commissions and born in 1912 or earlier; officers serving on extended service commissions without restriction on rank, age and seniority.

Secretarial Branch: Group captains of seniority July 1, 1948, or earlier; group captains born in 1904 or earlier; wing commanders born in 1909 or earlier; squadron leaders of seniority July 1, 1947, or earlier; squadron leaders born in 1910 or earlier; flight lieutenants and below with permanent commissions and with seniority of July 1, 1947, or earlier; flight lieutenants and below with permanent commissions and born in 1912 or earlier; officers serving on extended service commissions without restriction on rank, age or seniority.

R.A.F. Regiment: Group captains born in 1909 or earlier; wing commanders of seniority July 1, 1949, or earlier; wing commanders born in 1911 or earlier; squadron leaders born in 1917 or earlier; flight lieutenants and below with permanent commissions and with seniority July 1, 1948, or earlier; flight lieutenants and below with permanent commissions and born in 1917 or earlier.

Applications for retirement may be made by air commodores in any of the above branches and these will be dealt with individually by the Air Secretary, Air Marshal D. H. F. Barnett.

The signal sent by Air Ministry to other ranks is in similar terms. Those who wish to leave the Service by October 1, 1958, should apply direct to the A.O.C., R.A.F. Record Office (2 Division), Gloucester.

Categories of airmen who may apply now are as follows:—

Warrant officers, flight sergeants and sergeants born in 1907 or earlier in Trade Groups 1, 2, 3, 4, 5, 6, 7 and 9 (these trades, respectively, are aircraft engineering; radio engineering; armament engineering; electrical and instrument engineering; general engineering; mechanical transport; marine craft and air traffic control and fire services).

Skilled tradesmen only of the rank of warrant officer born in 1912 or earlier; flight sergeants born in 1915 or earlier; and sergeants born in 1919 or earlier, all with at least 17 years' pensionable service in Trade Groups 10 and 22 (General Service and R.A.F. Regiment respectively).

Warrant officers born in 1907 or earlier in Trade Groups 11, 12, 14, 17, 18, 19 and 20 (Ground Signalling; Radar Operating; Photography; Accounting and Secretarial; Supply; Catering and Police, respectively).

Warrant officers and flight sergeants born in 1907 or earlier in Trade Group 13 (Safety and Surface).

Compensatory Payments

DETAILS of compensatory payments to officers and other ranks who suffer a loss of entitlement to pensions through premature retirement under the defence cuts were published as a White Paper* last week. These apply to all three Services, but not to personnel recruited outside the U.K. on special conditions of service or to the women's Services, which are not affected by the arrangements for premature retirement.

**Cmd. 231, price 1s 6d, H.M.S.O.*

Director of Resettlement

THE Minister of Labour and National Service, Mr. Iain Macleod, last week gave details of the Regular Forces Resettlement Service being set up to co-ordinate all the agencies concerned with resettling ex-Regular Service personnel in civilian occupations. There will be an advisory board under the chairmanship of Sir Frederic Hooper (managing director of Schweppes, Ltd., and from 1945 to 1946 Director of Business Training at the Ministry of Labour); and Air Chief Marshal Sir Ronald Ivelaw-Chapman has been appointed Director of Resettlement. Sir Ronald, at present V.C.A.S., will take up his new appointment during September.

Command Appointment

HAVING last week handed over command of the Royal Pakistan Air Force, A.V-M. A. W. B. McDonald, C.B., A.F.C., has now been appointed A.O.C-in-C. Technical Training Command with effect from next January and with the acting rank of

A.V-M. A. W. B. McDonald.

air marshal. He will succeed Air Marshal Sir George R. Beamish, who is retiring.

A.V-M. McDonald became C-in-C. of the R.P.A.F.—now commanded by A.V-M. Asghar Khan—in May 1955, having previously been Director-General of Manning at Air Ministry from September 1952 and before that A.O.C. at Boscombe Down. In the 1930s he was responsible for the flying side of research at Biggin Hill into the technique of radar interception, culminating in the first such interception over this country in November, 1937, when he led a formation of three Gauntlets on to a Dutch airliner over the Thames Estuary. A.V-M. McDonald was awarded the A.F.C. in January 1938.

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

British Aerobatics

AS a result of the Lockheed Trophy Competition, you very rightly bemoan the absence in this country of a suitable light aerobatic aeroplane which will give our British pilots a reasonable chance of competing on level terms with their Continental rivals.

It may well be possible that by next year we shall have such an aircraft, but probably we still shall not have overcome an even greater handicap which you did not mention, and under which our British pilots suffer, and that is the difficulty of their finding suitable aerodromes near to their homes on which to practise. I do not know of a single aerodrome within easy reach of London where it is possible to keep an aerobatic machine at a reasonable cost, and to be able to take it out and practise at suitable heights whenever the occasion and weather is suitable.

Before the last competition, one pilot I know, unable to get permission, practised without permission at 6 o'clock in the morning, hoping there was no one about. Unfortunately, he was discovered and threatened that the aerodrome would be banned to him in future.

If the owner of any aerodrome near London is willing positively to encourage aerobatic pilots, rather than to discourage or definitely forbid, we shall be delighted to hear from him.

Claygate, Surrey. NORMAN JONES,
Chairman, The Tiger Club.

Light Aircraft A.R.B. Requirements

IN view of Mr. A. E. Bramson's letter (July 19) I would like to make it clear that there is no question of the Board prohibiting engine manufacturers from using motor-car accessories in suitable engine installations. Although no such proposals have been put before the Board since the projected, but uncompleted, Morris 100 h.p. light aero engine, the Board will at any time approve an engine fitted with these accessories provided it is capable of completing the appropriate type-test and that the system of quality control is such that the approved standard can be maintained in quantity production. The C.A.A. in America employs an identical procedure but, unlike the A.R.B., is able to put it into practice; the Board, of course, can only do so if such an installation is submitted for approval.

In addition, the Board will accept without question any American light aeroplane fitted with an American engine (including accessories) provided it has been granted a Certificate of Airworthiness issued by the C.A.A. The Board will also accept for installation in a British aeroplane any American light aero engine (including accessories) provided it has received type approval by the C.A.A.

The A.R.B. and the C.A.A. are in complete accord on this particular issue and Mr. Bramson makes a mistake when he suggests that the Board is to blame for the state of affairs which he describes.

London, W.C.2. R. E. HARDINGHAM,
Secretary, Air Registration Board.

[It should be added that Mr. Bramson's original communication also cited the case of A.R.B. Certificate of Airworthiness requirements for the Chipmunk, but that part of his letter was deleted in view of the fact that this aspect was fully discussed in these pages some months ago.—Ed.]

Hardly a Big Top

I AND many of my colleagues were saddened that in your leading article "The Big Top" on July 26 you should have accused the R.A.F. of being so much more top-heavy in its senior-officer-to-other rank ratio than either the Navy or the Army. For some years the R.A.F. has been working energetically to achieve just the opposite in its balance of man-power, and the following figures will, I think, prove conclusively that the R.A.F. has done extremely well in this respect. The impression given in your article results from the fact that you take "officers of air rank" as being equal to rear admirals and above or major generals and above. In fact, the junior air officer is an air commodore, and he is one step below the other two ranks mentioned. The ratio figure is therefore unfavourable and unrepresentative.

The facts are these. On July 1, for every air vice-marshal or officer of higher rank in the R.A.F. there were 1,813 airmen and N.C.O.s, *not including airwomen*. Towards the end of last year the ratio of air vice-marshals and above to all other members of the R.A.F., commissioned and non-commissioned, including airwomen, was 2,397:1. The corresponding ratio in the Army, at about the same time, was 2,746:1. In the Navy it was about 1,100:1. Considering that the R.A.F. is a highly technical force and that it necessarily has a higher officer-to-other-rank ratio the figures are extraordinarily good when compared to those of the other two Services, particularly the Navy.

It must also be noted that the ratio was arrived at by assessing the number of air vice-marshals and above *on the strength*. The number of these officers *on establishment* is somewhat lower; and some 10 per cent of all air rank appointments are in NATO and various Ministries outside the immediate R.A.F. structure. Again, air rank appointments are under constant review and no fewer than six have been discontinued already this year.

Far from being a top-heavy service, the R.A.F. is most creditably "under-brassed".

Tunbridge Wells, Kent. PER ARDUA.

Trooping Contracts

I HAVE read with considerable interest the statement in your issue of July 5 in connection with air trooping, in particular this following extract:—

"There is good news, too, from the trooping-contract front. Transair, whose two Viscount 804s are due for delivery in August, have won a contract from the Government to operate their Viscounts on trooping flights to the Mediterranean from October 1. The contract was, presumably, tendered for in competition with operators of twin pistoned-engined aircraft. Transair's success is a vindication of their long-standing 'calculated-risk' order for Viscounts, and a fulfilment of the Air Minister's promise in Parliament on May 9 that, where possible, future trooping contracts would be placed with the independents and that trooping would be done with modern aircraft."

I would like to correct the impression which is given to your readers by this statement when you refer to "good news from the trooping-contract front". The facts are that Eagle have satisfactorily operated the predecessor of this particular contract (as well as others) for nearly two years, using Viking aircraft. Some months before the issue of the invitation to tender for the renewal of this contract, we offered to convert the existing contract for operation with Viscounts, but the Government rejected this on financial grounds. Subsequently, in response to the invitation to tender, we, as holders of the existing contract, again offered Viscount aircraft, which we had ordered primarily for this type of work.

London, W.2. H. BAMBERG,
Chairman and Managing Director, Eagle Aviation, Ltd.

[As we go to press we learn that Eagle Aviation have cancelled their order, announced last April, for three Viscount 810s. Their order for two 800s still stands.—ED.]

The "All-British" Rule at Farnborough

IT was reported in *Flight* of July 19 that an Anglo-American aircraft in the shape of the S-58 Wessex is to "appear" at the S.B.A.C. show this year.

Does this mean that the S-58 will be allowed to perform in its natural element? Or will it appear as a seemingly lifeless piece of metal squatting miserably inside a rope barrier in the static park?

A revision of the "all-British" rule would, I feel sure, be welcomed by de Havillands (Otter), Austers (Agricola), Edgar Percival (E.P.9), and possibly even by Napiers (Eland Convair).

New Barnet, Herts. ONE OF THE CROWD.

FORTHCOMING EVENTS

July 27-
Aug. 5. National Gliding Championships, Lasham.
Aug. 7. Air-Britain: "Vickers Transports, 1920-1960," by P. W. Brooks, and Film Show.
Aug. 5-10. Institute of the Aeronautical Sciences: National Naval Aviation Meeting, San Diego, Cal.
Aug. 18. Swiss Aero Club: International Balloon Meeting, Bâle.
Aug. 18-25. Aeronautical Union of Jugoslavia: International Parachute Contest, Tivat-Boka, Kotorska.
Aug. 23-25. Sporting Flying Club: International Rally, Copenhagen.
Aug. 24-25. Puy Aero Club: International Rally, Le Puy.
Aug. 31. R.N.A.S. Lee-on-Solent, Hampshire: At Home.
Sept. 2-8. S.B.A.C. Show, Farnborough.
Sept. 2-13. Sixth Anglo-American Conference, Great Britain.
Sept. 5. Helicopter Association of Great Britain: Annual Dinner, Dorchester Hotel.
Sept. 9-15. Battle of Britain Week.
Sept. 14-15. Popular Flying Association: Rally, Sywell.
Sept. 15. R.Ae.S. Garden Party, Wisley.
Sept. 19-22. Austrian Aero Club: Innsbruck and Salzburg International Air Rally, Innsbruck.
Sept. 21. R.N.A.S. Abbotsinch, Paisley: At Home.

This is the finest air-to-air photograph we have yet received from Russia. It shows the new Il-18 Moscow turboprop airliner (see last week's issue) displaying its attractive lines before the Moscow State University. Note the Dart-like cowling of the outer 4,000 h.p. Kuznetsov turboprops.

CIVIL AVIATION

CONVAIR 880s FOR T.E.A.L.?

IN our June 14 issue we quoted Sir Leonard Isitt, chairman of Tasman Empire Airways, Ltd., as saying that his airline was choosing from among six new turbine airliners for the replacement of its DC-6s. Now comes a report from Wellington that T.E.A.L.'s general manager, Mr. F. A. Reeves, who has just returned from a two-month tour of British and U.S. aircraft manufacturers with his chief engineer, has recommended the purchase of a fleet of Convair 880s. Mr. Reeves says that the purchase of pure jets will mean that T.E.A.L. will be able to have "the same aircraft for a long period," because turboprops "will not be competitive with other aircraft during the second half of the next decade."

T.E.A.L., which is jointly owned by the governments of New Zealand and Australia, uses DC-6s for services between Auckland, Sydney and Melbourne and for Pacific island services (supported by Solent flying-boats). T.E.A.L. also operate to the U.S.A. and Canada in association with Qantas, and to Europe in association with B.O.A.C. and Qantas.

K.L.M.'s JET POLICY

BY contrast with T.E.A.L.'s plans reported above, Mr. I. A. Aler, president of K.L.M., says that after an "intensive study" his airline has decided not to purchase jets for European routes. He adds that K.L.M.'s fleet of Lockheed Electras will be able to compete with any other aircraft.

This statement from a source as influential as K.L.M. is most significant, because it comes at a moment when other European airlines seem to be inclining more towards the jet for short-haul work. B.E.A. are expected to announce their jet transport programme very soon; S.A.S. recently chose Caravelles; Sabena are reported to be "near to ordering" the same type of aircraft; and now comes news that Air France have taken up their option on 12 more Caravelles (to bring their fleet up to 24), and have placed an option on yet a further 12.

From Douglas, Santa Monica, we learn that K.L.M. have increased their order for 10 DC-7Cs to 11, with an option on four more. In addition, K.L.M. have ordered a Lockheed L.1049H to add to their Super-G fleet, plus an option on two more L.1049Hs. These new K.L.M. orders for piston transports are, says Mr. Aler, in anticipation of third-class fare business on the Atlantic in 1958.

On the subject of helicopters, K.L.M.'s latest thoughts are that these are at present uneconomical, and Mr. Aler feels that VTOL aircraft offer more promise.

CAPITAL'S NEW PRESIDENT

CAPITAL Airlines have appointed a new president and chief executive in succession to Mr. J. H. Carmichael, who becomes chairman of the board. He is Maj-Gen. David H. Baker, a financial and procurement expert who retired from the U.S.A.F. on July 24 and took up his new appointment on the following day.

Mr. Carmichael will remain directing head of the airline, handling all policy matters, leaving to Gen. Baker the control of day-to-day operations. The general has been charged with the task of bringing to Capital a stronger economic control—very much the same job that faced Mr. Carmichael when he was elected president of the near-bankrupt airline in 1948. This reinforcement of Capital's management has obviously been made with a view to placing the company's financial position (which recently necessitated the deferment of their Comet order and of 15 additional Viscounts) on a firmer footing. Last month the airline predicted an operating loss of £900,000 for 1957.

Like "Slim" Carmichael, Gen. Baker has also been an airline pilot. He flew the mails between Newark and Cleveland in 1932-34. Before his retirement from the U.S.A.F., he served as director of procurement and production in Air Material Command.

NEW INDEPENDENT TROOPING CONTRACTS

IT is announced by Airwork that their trooping contract to the Far East has been renewed for one year as from September. Previously half of these flights were sub-contracted to Skyways; but the latter company will now make trooping flights in its own right.

Skyways, who have carried more than 200,000 troops and their families from the U.K. to various Middle and Far East destinations, have been awarded a new contract for trooping flights to the Far East. Both Skyways and Airwork will use Hermes.

CEYLON'S AIRPORT

THERE has been uncertainty for several years about the future of Ceylon's international airport at Ratmalana. Now, writes a correspondent in Colombo, the main runway is cracking to such an extent that repair work is becoming more and more difficult.

Ceylon's Junior Minister of Transport, Mr. Henry Abeywickreme, says: "I am dead against continuing the use of Ratmalana as our main airport. Katunayake [the R.A.F. base due to be handed over to the Ceylon Government] is definitely the more suitable airport. I shall fight tooth and nail for Katunayake."

Unfortunately, it seems that all the airlines operating through Colombo are equally dead against a move from Ratmalana, which they consider would be the ideal airport if the runway was made stronger.

VARIG'S RE-EQUIPMENT PROGRAMME

A CORRESPONDENT in Rio de Janeiro writes that the option which VARIG hold on eight Viscounts may not be taken up because of foreign-exchange difficulties. However, the airline will have access to the five Viscount 810s order by VASP, the all-domestic Brazilian operator with whom VARIG have entered into a joint operating arrangement. These Viscounts will, the report goes on, fill VARIG's interim needs, but for the next stage the Caravelle will "most probably be chosen, over-riding an earlier interest in the Electra."

For its long-haul Rio - New York needs, writes our correspondent, VARIG is "strongly rumoured" to be about to order three Boeing 707s, possibly with Rolls-Royce Conways, for delivery in late 1959.

THE AIRLINES FIGHT INFLATION

INFLATION is a word on everyone's lips, not only in this country but abroad, and the airlines of the world are having as bitter a fight against rising costs as anyone. Now B.E.A. are reported to be seeking domestic fare increases of 10 to 25 per cent. The last increases (up to ten per cent) took effect eight months ago.

The Prime Minister, in the Commons debate on inflation last

CIVIL AVIATION . . .

week, considered that the problem was primarily a social one, and that government policy alone could not resist inflation.

But the U.S. Civil Aeronautics Board, the U.S. Government's agency for regulating America's airline industry, appear to consider otherwise. The C.A.B. have so far rejected the U.S. domestic airlines' request for a six per cent fare "hike", and have turned down also their international carriers' recommendation—made through I.A.T.A.—for a North Atlantic increase of five per cent. This latter action, which was not lightly considered, has inevitably incurred the displeasure of other countries—including Great Britain—whose national airlines fly the Atlantic.

We have indicated (July 19) how the C.A.B. arrived at their decision to refuse domestic increases: a thorough analysis of individual airline accounting systems has been undertaken, and the general conclusion reached—rightly or wrongly—that the situation is not so bad as the airlines have suggested. C.A.B. have similarly examined the PanAm and T.W.A. case for five per cent higher Atlantic fares, and decided that they see no reason to alter their opinion that Atlantic fare-levels are already higher than are justified.

It is certainly a sound principle that the general public should be able to feel that applications for fare-increases by public transport operators should be so carefully scrutinized. No airline—least of all B.E.A., whose domestic network is up against the world's stiffest surface competition—wants to price itself out of a market which it is only just beginning to develop. But it would be good to feel that the Corporations and their guardian Ministry, and the impartial advisory councils, will not bow too deeply and too easily before rising costs.

INFRA-RED PROXIMITY WARNING

FOLLOWING the hint that infra-red detection might be used for an airborne collision warning system (reported in these columns on July 12) comes the news that Aerojet General are releasing details of such a system in Los Angeles. The infra-red proximity warning indicator would weigh as little as 50 lb installed; and a production prototype might be airborne within six months. In addition, Raytheon are reported to be working on such a system, while Radio Corporation of America are investigating the use of conventional weather radar for the purpose.

TURKEY BUYS VISCOUNTS

THE closer co-operation between B.O.A.C. and Turkish State Airlines (Turk Hava Yollari), foreshadowed in our issue of May 3, has been fulfilled with the signing in Ankara of an agreement between the two airlines and Vickers-Armstrongs (Aircraft), Ltd. Under the terms of this agreement B.O.A.C. will, it is reported, buy shares in Turkish Airlines to the value of £500,000 and will open on their behalf a £1.5m credit with which they will buy five Viscount 700s and spares.

B.O.A.C. have agreed to forgo the delivery of one of their 12 Viscounts (ordered for associates) so that one 754 can be delivered to Turkey by the end of this year. The remainder will be delivered next year and will supplement Turkish Airlines' fleet of 21 DC-3s and seven Herons. The Turkish order brings the total number of Viscounts sold to 372.

AER LINGUS YEAR

AT the end of their financial year, and soon after they celebrated their twenty-first birthday, Aer Lingus were able to declare an operating profit (after taxes and other charges) of £67,061. Although slender enough, this represents an increase in operating revenue of 27 per cent over the 1955-6 figure (a year which started with a debit balance). It was largely brought about by a 15 per cent increase in passenger traffic and by a five per cent improvement in passenger load factor (to 70.7 per cent).

Part of the increase can be attributed to the development of the airline's Viscount operations and part to the intensive efforts that Aer Lingus make to smooth out their irregular and seasonal traffic flow. Last year an earlier slump in Dublin - Paris traffic was remedied by a special excursion fare, and a single fare was charged for a winter week-end round-trip between Birmingham, Manchester and Dublin. On the latter services, however, the very high load-factors required to break even were not achieved.

Aer Lingus, like every other airline, has been facing rising costs, but apart from fare increases of between two and four per cent made last year (in line with most other European airlines) the passing-on of costs has been resisted. It remains to be seen whether this policy can be continued during the current year. As a result of the revision last year of the bilateral agreement of 1946 between the British and Irish Governments, Aer Lingus expect a temporary decline in load-factors and revenue. But in long-term return they have accepted a reduction in their Anglo-Irish services (British operators may now compete with Aer Lingus between Dublin and Birmingham, Cardiff, Manchester, Liverpool and London and operate other services into Dublin) in exchange for the rights to open up Irish services through Manchester to the Continent. They regard this as the "logical next stage in their evolution."

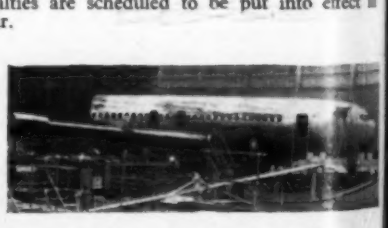
RESOLVING NO-SHOW

THE problem of the airline passenger who makes a reservation but does not turn up has long plagued American domestic airlines. Not all suffer to the same extent, and most are loath to impose conditions—even those mutually agreed and put into effect by all carriers—upon their passengers. The airlines understandably wish to avoid adding complications to the straightforward business of buying a ticket and making a reservation, and earlier this year (see *Flight*, February 8) they failed to agree to the Air Transport Association's plan to impose a penalty on the no-showing passenger.

Nevertheless, the plan proposed by the A.T.A. is progressively being put into effect. The first stage began last September, when a minimum ticket-collection-time-limit was introduced which stipulated the number of hours before the flight that a passenger should collect his ticket. If he did not do so, his reservation was cancelled, and if an airline reduced the limit it became subject to a heavy fine. Since customers who have paid for their tickets are less likely to cancel their reservations than those who have not, the airline tries to persuade the customer to collect his ticket as soon as possible after making his reservation, and a time limit inside the minimum is usually mutually agreed between the airline's ticket office and the prospective passenger. To overcome some of the snags that this system has raised, more use is being made of the post, travel agents and banks for the sale of airline tickets.

The second stage of the A.T.A. plan, the "reconfirmation rule," has just been introduced. A passenger breaking his journey overnight or longer is now required to reconfirm his reservation before continuing his flight or starting a return journey, and this he must do at least six hours before departure. Even if surface transport has been used for one stage of the journey, reconfirmation of reservation is required if the next stage of the trip is to be by air. An exception is made in the case where the passenger "stops over" for less than 12 hours, even if this is overnight.

The final point of the plan is the third-stage safeguard against no-show which imposes a $3 penalty upon passengers who have purchased a ticket but fail to make use of their reservations. This has been the most contentious clause in the A.T.A. solution of the no-show problem, but disagreements seem to have been resolved and no-show penalties are scheduled to be put into effect in September this year.



First production Comet 4 for B.O.A.C. and first production Boeing 707 for PanAm (detail, above, from p. 102 picture last week) appear to be running neck-and-neck towards their certification target-dates of late 1958. These pictures were taken towards the end of last month.

Scottish Aviation's Twin Pioneer demonstrator G-AOEP is seen here over Sydney at the end of its 23,000-mile tour (see last week's report).

BREVITIES

PROVISIONAL figures issued by K.L.M. for the first six months of 1957 show a profit of £730,830. Total operating revenue from January to June, 1957, was £21.9m, with total costs, including depreciation, of £21.5m. Allowing for taxes on income, plus a tax reduction of some £500,000 on capital investments, the net profit is nearly £150,000 more than the corresponding period in 1956.

* * *

S.A.S. representatives have been in San Diego discussing the 880 jet transport with Convair.

* * *

Australian domestic airlines have flown 11 million passengers in the past six years without a fatality.

* * *

American Airlines are to dispose of about ten Convair 240s. DC-6s are to be used in their place.

* * *

Ansett Airways of Australia are reported to have ordered three Lockheed Electras. The airline is to increase its Convair 440 fleet from two to ten.

* * *

Ekco Airborne Search Radar Type E120, supplied by Ekco Electronics, Ltd., is being installed in the Bristol Britannia 302s shortly to be delivered to Aeronaves de Mexico, S.A.

* * *

Silver City Airways transported two Royal cars when Her Majesty the Queen visited the Channel Islands last week. One was flown from Southampton to Jersey and another from Southampton to Guernsey.

* * *

The air talks in Washington between the U.S. Government and a Belgian delegation have ended without a decision on the Sabena request for a route to California. "We gave them no encouragement," a U.S. official is reported to have said.

* * *

Mr. Airey Neave, Joint Parliamentary Secretary to the M.T.C.A., and Sir Alfred le Maitre visited Hurn on July 19 to inspect the fire service and to present a station-efficiency trophy. They also inspected Viscount 700 production.

* * *

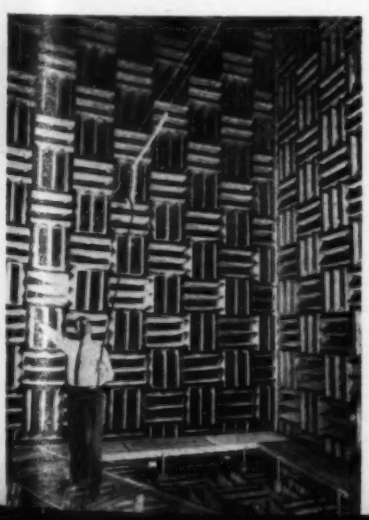
Recently demonstrated was the new Aquonly J25 iced-drinks dispenser, which should prove popular in airport restaurants and crew-rooms. The makers (Ice Water Dispensers, Ltd., 87/91 Shaftesbury Avenue, London, W.1) are specialists in such equipment, with Sabena and the U.S.A.F. among their customers.

* * *

The Council of the Air Registration Board announces the issue of the following Notices to licensed aircraft engineers and to owners of civil aircraft: No. 4, Issue 21, July 1, 1957, (*Propellers Approved For Use On Civil Aircraft*), and No. 46, Issue 2, July 1, 1957 (*Identification Tags On Control Cables With Swaged Ends*).

* * *

A week-end course on *The Problems of Management in Transport* has been arranged by Ashridge College in conjunction with the Institute of Transport for the week-end September 13-16. Enquiries and applications should be made to the Secretary, Ashridge, Berkhamsted, Herts. The course is open to men and women, and the cost is £4 4s.



This is a special chamber built by Douglas, Santa Monica, to test the soundproofing of the DC-8's structure. This "anechoic" room is claimed to produce nearly 100 per cent sound-absorption.

THE COMMONS DEBATE CIVIL AVIATION

(*continued from page* 151)

"There is no possibility that the Corporations can be other than the main flag carriers for this country. That is just a fact of life and existence. It has nothing to do with the policies which Ministers made adumbrate in the House of Commons. . . . I do not receive any complaints, nor do I think that there are any complaints, from the Board of B.O.A.C. at the way in which I have backed it up since I have been Minister of Civil Aviation. If the Hon. Member wants proof of that, he had better consider the quite natural and fair complaints that I get from the private enterprise industry, pointing out the enormous sums of money that are being spent on new aircraft, the great sums of public money invested in this Corporation, and the way in which the Government supports it in every possible way, both in national and international affairs.

"It does not lie in the mouths of Hon. Members opposite to talk about breaking bipartisan policy and dragging this matter into the House of Commons. I did not do it. They did it. . . . It is the Hon. Member for Reading [Mr. Mikardo] and his colleagues who are guilty of double talk in this debate, not myself.

"B.O.A.C. and B.E.A. are stronger and more efficient and more competitive than they have ever been. They have better aircraft, better opportunities, and they are carrying more passengers. For Hon. Members opposite to talk about great harm, and cutting away foundations, and all those things, is not to talk sense.

"I wonder whether the air can go on developing at this rate without in the end—nobody knows when—making serious inroads into the shipping business. If that be true, is it really wise to impose a tight monopoly to keep those great companies, with all their knowledge and expertise, out of the air altogether? I wonder whether Hon. Gentlemen opposite would care to say that that is their settled policy? If they do, all I can say is that it is entirely contrary to the national interest.

The Colonial-coach services would never have come about if private money had not been risked. These things increase the total number of air passengers, and as such they are clearly of advantage to the Corporations, which will always enjoy a preponderating share of the traffic.

"I do not know when the new high-density T.34 services will come into being, nor does anybody else, but obviously it was right that the A.T.A.C. should take some account of the future, although its findings must at the moment be vague, and largely conjectural.

"There is a case to be made by the independent companies which say that *they* should be having 70 per cent or more and the Corporation should be having a lesser share. The private enterprise companies do not think that they will have a fair distribution of what they have built up by their own enterprise and money. Do not run away with the idea that I am giving some great and prized favour to these companies.

"The Hon. Member for Eton and Slough [Mr. Fenner Brockway] said that he was worried about the aircraft industry. No doubt. So are we all. He could not have made my case better for me. Because if there is a case for encouraging independent companies it is to increase the size of the home market. There again, I find this astonishing difficulty which the Opposition always have in trying to relate nationalization to the facts of life. It is a very difficult thing to do.

"The Opposition will be extremely unwise if they go into the Lobby against something which is elementary justice in the interests of the Corporation itself. If the Opposition wish to push monopoly and nationalization to these extreme ends, let them vote and be hanged to them."

One of the Paul Aubert Super Cigales of the Air France Aero Club, seen at Le Bourget. The club also has Jurca Tempêtes on order.

CLUB AND GLIDING NEWS

THE first two midget-aircraft race meetings of the season in the U.S.A. are to be held on August 10-11 at Oshkosh, Wisconsin, and on August 31-September 1 at Fort Wayne, Indiana. The Professional Race Pilots' Association reports that further meetings are expected to be organized this year, and that the U.S. National Air Races should be resumed in 1959. Over 100,000 people attended the three regional air-race meetings last year, when every national speed record for race aircraft in the 190-cubic-inch class was broken.

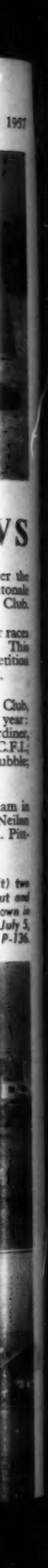
ANNUAL general meeting of the Australian Women Pilots' Association will be held during the weekend of October 4-6, following the finish of the 1957 Women's Air Reliability Trial at Parafield Aerodrome, South Australia. The week-end events will include a handicap flying competition using the Tiger Moths of the Royal Aero Club of South Australia.

ELSTREE Flying Club have introduced new maintenance facilities at their home aerodrome. Since the club began operations five years ago, routine servicing has been carried out under contract by Light Plane Maintenance Services (operated by Mr. E. E. Chick) and major work has been undertaken at the main base of Derby Aviation (operators of the club) at Derby. A separate engineering section, under chief engineer C. E. Goodall, has now been established at Elstree; it is thus hoped to improve utilization and to save the time, trouble and expense of frequent ferry flights to and from Derby. First solos have recently been achieved by three pupils trained *ab initio* on the Elstree Chipmunk —R. Amos, D. Langley and P. Laffy.

A TOTAL of 67 aircraft from 12 European countries attended the third International Air Rally of the Swiss Watch at Bienne last month. Seventeen of the machines were from this country. Winner of the rally was veteran pilot Wolf Hirth of Germany with 1,094 pts, with M. Meers of Belgium second and M. Zurkinden of Switzerland third. Of the British pilots, A. Linnell was ninth and G. Linell tenth. The former was the only entrant to be awarded 1,000 pts for arriving exactly on E.T.A. The rally was organized by the Bienne Flying Club, under the patronage of the town council of Bienne, l'Association Cantonale Bernoise des Fabricants d'Horlogerie and the Swiss Aero Club.

AMONG the many club events following the Coventry air races was Wolverhampton Aero Club's At Home on July 7. This took the form of a luncheon invitation and an arrival competition which was won by Mr. G. H. Davies flying the Sparrowjet.

AT last month's first general meeting of the Kent Gliding Club, the following committee was elected for the coming year: Ian Abel, chairman; Eric Clegg, treasurer; Mrs. Joy Gardiner, secretary; Ken O'Riley, C.F.I.; Peter Crabtree, assistant C.F.I.; Margaret Crabtree, social secretary; Edward Day; Roy Hubble; Dennis Monckton; and Colin Moore.

AMONG a number of notable gliding flights from Lasham in recent weeks were two "Gold C" heights—by John Neilan on July 14 in a Slingsby T.42B Eagle (12,950ft) and H. A. Pitt-Roche on July 21 in a Sky (12,000ft).

Sicilian scenes at the island's recent Ninth International Aerial Tour, in which 89 aircraft participated: (clockwise from upper left) two attractions from France, one of which is a Jodel-Wassmer D.120; an Italian Falco F.8L, four of which took part; pilot H. Burgerhout and navigator H. Kruthoffer of Holland, who came third in their Swiss Bonanza; and two Italian pilots, seen getting their feet up and heads down in an Alaparma Baldo 75, a twin-boomed machine powered by a 75 h.p. Praga engine driving a pusher propeller. As reported in "Flight" of July 5, the Aerial Tour was won by Robert Goemans of Belgium in a Piper Apache; runner-up was Comptess Carina Negrone in a Piaggio P-136.